Differentiated Products, Divided Industries: Firms and the Politics of Intra-Industry Trade

Differentiated Products, Divided Industries: Firms and the Politics of Intra-Industry Trade

A dissertation presented
by

Iain Guthrie Osgood

to
The Department of Government
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy
in the subject of

Political Science

Harvard University
Cambridge, Massachusetts
May 2013

Thesis advisor | Author

Jeffry A. Frieden | **Iain Guthrie Osgood**

Differentiated Products, Divided Industries:
Firms and the Politics of Intra-Industry Trade

Abstract

Which firms support trade liberalization and under what circumstances? The dominant approaches to trade politics ignore two key features of modern international commerce – firm heterogeneity in export performance and intra-industry trade – which jointly imply that industries will be divided over bilateral trade liberalization. This dissertation examines the impact of these features on the politics of trade, exploring the preferences of firms, the attitudes of industries, and the motivations of politicians, in turn. When products are differentiated, firms which do not export generally oppose trade liberalization even in industries at a comparative advantage relative to their foreign trade partners. Not all exporting firms will be supporters of trade, however. For example, the largest exporters may oppose trade liberalization in their export markets due to increased competition from compatriot firms. It is then argued that industries are most likely to be divided where product differentiation is high and differences in competitiveness between trade partners are muted. This pattern is documented empirically in a study of US industries' attitudes toward the US-Korea and US-Australia Free Trade Agreements. Finally, a complete political economic model of trade policy determination with heterogeneous firms is developed. The changing preferences of politicians across different economic and institutional settings are explored, and comparative statics identified which show how equilibrium tariffs change with key industry features.

Contents

Acknowledgments

I am very grateful to the members of my dissertation committee: Jeff Frieden, Elhanan Helpman, Michael Hiscox and Dustin Tingley. I have benefitted enormously from their feedback as I have developed this dissertation. In particular, Jeff Frieden has been an enormous source of help and encouragement from the very beginning of my doctoral program.

I am also grateful to the many readers of the papers which constitute this dissertation. These include: Andrew Coe, Moonhawk Kim, Jennifer Larson, Maggie Peters, Shahrzad Sabet, Ken Shepsle, Jesse Schreger, and George Yin, as well as the participants in the Harvard Research Workshop in International Relations and the Harvard Research Workshop in Political Economy.

My research has been supported by the Weatherhead Center for International Affairs, the Institute for Quantitative Social Science and the Department of Government at Harvard University. Some of the most productive presentations of this research as it developed occurred at the Graduate Student Affiliate lunch in the Weatherhead Center. Clare Putnam, especially, has always asked about by progress and given me encouragement. I also received superb research assistance from Hee Eun Kim and Jane Lim.

My parents, Russell and Paula Osgood; my brothers, Joe and Mike; and especially my older sister Mollie have given me constant support over the years. Katherine's parents, George and Mary Jackson, have been similarly encouraging and supportive. Katherine and I have also spent many happy afternoons in Rockport, MA with three wonderful friends: Archie, Maggie and Pennie Osgood.

I am most grateful to my wonderful wife, Katherine Osgood. She has helped me through every challenging moment and supports me in everything I do. She also adopted a very sociable friend into our family from the Animal Rescue League of Boston, a mouse named Aesop. Katherine, I love you!

Chapter 1

Introduction

Which firms support trade liberalization and under what circumstances? The dominant approaches to trade politics imply that industries are united in support or opposition to trade. These approaches are based on an incomplete account of trade, however, which ignores two key features of modern international commerce: firm heterogeneity in export performance and intra-industry trade. This dissertation explores the political implications of these ubiquitous features of industries in the modern global economy. The preferences of firms, the circumstances under which industries are united or divided over bilateral trade liberalization, and the government's problem in optimally setting trade policy are each examined in turn.

The second chapter of this dissertation explores the preferences of firms in industries with intra-industry trade using a model of trade with heterogeneous firms developed in Melitz and Ottaviano (2008). Contrary to existing theories, industries are divided between firms that favor freer trade and firms which oppose it. Firms which serve only the domestic market will generally oppose trade liberalization, even in export-competing industries. The interests of exporting firms, however, are less easily summarized. For example, the largest exporters may oppose *further* trade liberalization in their export markets due to increased competition from compatriot firms. The least productive exporting firms will also oppose trade liberalization because losses in the domestic market outweigh gains abroad. Industry-wide coalitions on trade therefore face previously unrecognized challenges, and disagreement among associations representing firms producing the same products is predicted. In particular, industries will be more divided when product differentiation is high, and when the parties to trade liberalization are similar in size and competitiveness.

The third chapter expands on the theory of intra-industry divisions, developing three empirical implications of firm heterogeneity and product differentiation. These are that industries will be divided over bilateral liberalization; trade agreements will find support in both countries even in a single industry; and that industries at a comparative disadvantage will nonetheless support freer trade when products are differentiated. The first two of these outcomes are especially likely in industries where differences in competitiveness between countries are muted. Intra-industry divisions over trade arising from multinationalization and reliance on imported inputs are also examined. It is argued that only trade in differentiated inputs can generate disagreements within industries over trade liberalization.

This theory is then tested on a new dataset of industry attitudes towards the US-Korea FTA and the Australia-US FTA. Patterns of intra-industry disagreement and bilateral support *in the same industry* are closely linked to the possibility of intra-industry trade, but not consistently explained by the extent of FDI. Foreign sourcing of differentiated inputs also explains these outcomes, but its effects are small relative to those of product differentiation.

The final chapter examines theoretically the problem of a government unilaterally or bilaterally setting trade policy for an industry with heterogeneous firms and a differentiated product. It emphasizes the changing tradeoffs faced by a government balancing producer and consumer interests across a variety of political and institutional settings. A rich set of comparative statics linking country, industry and firm characteristics to equilibrium trade barriers are also identified. Three results are emphasized. First, trade barriers are generally diminishing in consumer love-of-variety, the key driver of intra-industry trade. Second, under certain conditions foreign firms will prefer a small level of NTBs in their export market, proving an optimal trade barrier argument for exporters. Third, a source of gains from trade negotiations unique to industries with differentiated products is explored: to avoid mutual damage to exporting firms in an industry featuring intra-industry trade.

Chapter 2

A Theory of Firm Preferences over Trade Liberalization

Introduction

American manufacturers of textiles were deeply divided over CAFTA-DR, a free trade agreement between the United States, the Dominican Republican and five Central American trade partners. These divisions were most visible in the competing and contradictory assessments of CAFTA given by the industry's trade associations. The anti-CAFTA associations argued that the agreement was "loaded with provisions that will allow Chinese and other non-regional fabrics to enter the U.S. in garment form" and would "make it easier for U.S. companies to outsource high-paying manufacturing and service sector jobs". The textile associations supporting the agreement felt it would create "a permanent duty-free platform to ship billions of dollars worth of yarns and fabric" and "protect textile jobs" in the United States.[1]

The terms of this debate echoed a similar split among textile manufacturers over NAFTA, 12 years earlier. In that dispute, opponents in the textile industry had emphasized threats to US manufacturing and jobs from imports and outsourcing. Supporters of NAFTA had touted the opportunities to increase textile exports to Mexico, to be made into apparel. Who was right? Both, as it turns out. Textile exports to Mexico and Canada expanded 223% from 1993 to 2000 while US textile imports from these countries increased 264%.

These kinds of intra-industry divisions over trade are a recurrent feature of debates on trade policy, but the dominant models of trade politics predict that firms in the same industry will share the same preferences. Export-competing industries should favor multilateral liberalization of trade, while import-competing industries should be united in opposition. Recent empirical and theoretical developments in the study of the export performance of firms call this simple picture of attitudes toward trade into question, providing a new explanation for these divisions.

The literature on firm performance finds that most industries are divided between firms which are capable of profitably exporting and firms which serve the domestic market only. I argue here that in industries where products are differentiated, so that countries are both importers and exporters of varieties of the same good, firm heterogeneity in export performance creates intra-industry disagreements over trade. Non-exporters see in trade liberalization only costs, due to intensified competition in the home market from foreign-based producers. Exporters see both threats to domestic market share and opportunities in foreign markets as consequences of trade liberalization. They will support free trade if the latter outweigh the former.

This paper develops this basic insight into a series of original propositions about the preferences of firms, and then aggregates these preferences into measures of overall industry support and opposition. Two major claims about preferences are developed. First, industries which feature product differentiation will generally have a set of firms that favor freer trade and a set of firms which oppose it. These divisions can exist in industries at a comparative advantage and disadvantage, although the balance between supporters and opponents will of course differ. There are also instances – where a trade deal's terms are too unequal or foreign firms are too competitive – where industries will be united in opposition to trade liberalization.

Second, firm productivity is the crucial determinant of both export opportunities and support or opposition to free trade, but exporting and support for free trade are not synonymous. The least productive exporters will oppose trade liberalization because the increases in profit from exporting do not fully compensate losses incurred in the domestic market. More surprisingly, the most productive exporters are generally not the greatest beneficiaries from trade liberalization, and they may even oppose liberalization due to increased competition in foreign markets from compatriot firms.

With a model of firms' preferences over trade liberalization in hand, a series of comparative statics are derived which establish the conditions under which industries will be divided over trade. Differences in technology play a crucial role in determining the level of support for trade. As the distribution of firm productivities shifts toward higher costs, more firms will oppose trade liberalization. Country size, a non-technological source of comparative advantage, also plays a key role. In most instances, the benefits of gaining access to larger markets will be exceeded by the costs of competing with industries from big countries, which have more firms and are more efficient.

The extent of product differentiation is also important. Under a plausible set of conditions described in the paper, industries at a comparative disadvantage in the production of a differentiated product become more in favor of trade liberalization as product differentiation increases; industries at a comparative advantage become more opposed to trade liberalization. Product differentiation therefore fractures the united opposition to trade of import-competing industries, because some producers will be able to find a market for their good abroad even if it is relatively expensive.

The final section of the paper discusses the implications of these findings in considerable detail. For now, the contribution to the literature on trade politics can be summarized in several points. Most fundamentally, this paper develops a theory of preferences over trade policy which is better matched to the empirical patterns of modern international trade. A complete account of preferences over trade requires a precise description of the distributional impact of trade liberalization. Extant models do not consider two widespread features of trade – firm heterogeneity and intra-industry trade – which significantly alter our picture of preferences over trade.

The impact of bilateral trade liberalization, and the patterns of support and opposition, are strikingly different in industries producing homogeneous commodities and industries producing differentiated products. All firms producing a commodity share the same preferences over trade liberalization. They win or lose together. Firms producing a differentiated product face very different effects from trade liberalization depending on their ability to export, and will frequently be divided over trade. Still, there are circumstances where all firms will share the same preferences over trade, as noted above. The paper therefore provides a theory for when intra-industry disagreements over trade are likely to occur.

It is also argued that intra-industry divisions over trade will strongly impact the organizational dimension of trade politics. Industry associations play a fundamental role in organizing and representing firms' interests on trade. Effective organization faces two previously unrecognized impediments, however. Firms in the same industry may disagree over whether to support or oppose multilateral trade liberalization, even as the collective action problem remains unresolved. Moreover, attitudes are situational – they depend on the features of the trade partner and the terms of the trade deal – so firms' preferences may be inconsistent over time and across trade liberalizations. Broad industry-wide coalitions on trade are therefore not predicted for industries producing differentiated products.

The paper proposes a new alternative in the long-running debate on factor specificity and trade politics. In the standard approaches, whether capital is completely mobile within an economy or stuck in a particular industry determines whether owners of capital will share attitudes toward trade as a class or will disagree based on their industry's comparative advantage. Here it is assumed that capital is immobile even within industries and that international competitiveness has roots in factoral-, industrial- and firm-based determinants. Of course, this suggests an extra unit of analysis – the firm – and that the appropriate area to look for coalitional boundaries over trade lies within both factors and industries.

Finally, the paper provides new explanations for two puzzling features of the post-war international trading regime. First is the apparent ease of multilateral liberalization in differentiated products compared to homogeneous products, such as agricultural goods. It is argued that the internal divisions and organizational difficulties faced by industries producing differentiated products provide one explanation for this pattern. Second is the enormous popularity and success of bilateral and regional trade agreements compared to potentially more significant multilateral agreements. The approach here focuses on market size-induced productivity improvements in large countries producing differentiated products. Regional agreements enable governments to expand choice for consumers by growing trade with smaller and less efficient countries, while avoiding widespread opposition from firms caused by liberalization with the largest and most efficient countries.

Existing literature

This research is among a small but growing number of papers in international political economy which build off of the literature on variation in firm performance in export markets.[2] At least since Melitz (2003) there has been a sense that the 'new, new' trade theory's focus on variation among firms in export performance could contribute to understanding trade politics. This paper advances this broad research agenda in several ways. First, it clearly lays out the set of conditions under which intra-industry divisions are likely to occur. A key argument of this paper is that firm heterogeneity in exporting on its own is insufficient to generate intra-industry divisions over trade. Product differentiation is a crucial extra condition

[1] These quotes were taken from the following sources, respectively: National Textile Association (2005), Shuster (2005), National Council of Textile Organizations (2005*b*) and National Council of Textile Organizations (2005*a*). The data in the succeeding paragraph was taken from the International Trade Administration's TradeStats Express™, available at http://tse.export.gov/TSE/.

[2] For papers using models of firm heterogeneity to explore tariff setting, see Abel-Koch (2010), Chang and Willmann (2006) and Ossa (2010). Plouffe (2011) provides evidence linking productivity to support for trade liberalization. For an application to firm lobbying for the opening of foreign markets, see Kim (2012). Walter (2010) discusses this literature in the context of workers' support and opposition to globalization.

because it leads to intra-industry trade, and generates systematic price differences among firms. In addition to product differentiation and firm heterogeneity in productivity, three additional factors are emphasized: firm-specific capital; short- or medium-term time horizons; and, the absence of variety specific protection. Second, it shows that even when these conditions are met, industries may still be united on trade. Third, it systematically examines the impact of trade liberalization in already partially-open economies.

Firm-level explanations of trade preferences have played an important role in the trade literature in discussions of multinational corporations and trade policy (Gilpin, 1971; Chase, 2004). Firms with foreign plants naturally have a very different perspective on trade barriers in their home market than firms which produce domestically. This intra-firm trade then provides an explanation for intra-industry divisions over trade (Milner, 1988*b*). This paper develops a separate argument for intra-industry divisions over trade, in which firms producing domestically agree on the value of protection at home, but disagree on whether to sacrifice that protection to gain access to markets abroad.

This research also revisits an earlier literature in political science on trade politics with intra-industry trade flows. When the ubiquity of two-way trade in the same product was first noted, it was argued that trade politics in industries with significant intra-industry trade might be less divisive. If two countries can mutually export the same good to one another, then perhaps both industries – as well as consumers – can end up as supporters of trade, and trade politics will be more harmonious.[3] Integrating the now well-established facts on firm heterogeneity in export performance with intra-industry trade helps to clarify in what sense this is true. Far from creating consensus over trade, intra-industry trade and firm heterogeneity create divisions *within* industries as well as between.

Outline

The rest of the paper proceeds as follows. The first section introduces the model of the economy which underlies all of the subsequent results which follow. The model was first developed in Melitz and Ottaviano (2008). The presentation in this section is mostly non-technical, focusing on the parts of the model which are crucial to understand the results which follow. In particular, firm heterogeneity in productivity, product differentiation, and intra-industry trade are described in some detail. Appendix A provides a complete treatment of the model, demonstrating how to solve the model, which originally featured a variable cost-of-trade, with an *ad valorem* tariff. This extension permits exploration of both tariff and non-tariff barriers, both of which are prevalent as barriers to trade.

The second section provides a definition of support and opposition to trade, and briefly discusses some of the key issues associated with translating the literature on firm heterogeneity into a model of preferences over trade policy. The third section describes the patterns of support and opposition to trade which occur when coun-

[3] See, for example, Krugman (1981) and Alt et al. (1996). See also Gilligan (1997) and Bombardini and Trebbi (2012) for an alternative perspective, which emphasizes the search for firm- or variety-specific protection.

tries move from autarky to trade, and when trade barriers are reduced in already partially open markets. In each case, the focus will be on three questions: What firm gains the most from trade liberalization, if any? Under what circumstances will no firms gain from bilateral trade liberalization? Which firms will favor and which firms will oppose trade liberalization, and how does their support depend on their productivity? As will be shown, the answers to these questions depend crucially on whether the pre-liberalization equilibrium is autarkic or not.

The fourth section derives or simulates a number of comparative statics which connect key features of the countries or industries to the overall rate of support or opposition to a given trade deal. It is shown that Ricardian and non-Ricardian sources of comparative advantage play an important role in determining the extent of support for trade liberalization. The role of product differentiation is also explored. These comparative statics are then applied to several outstanding empirical questions in trade politics. In the conclusion, the paper sums up the implications of firm heterogeneity, and the results derived here, for the politics of trade.

The Model of the Economy

This section provides a summary of the key features of the economic model which underlies all of the subsequent results. Two features of the economy are emphasized. First, consumers have a taste for variety, preferring an assortment of differentiated types to a homogeneous product. This generates the possibility of intra-industry trade because consumers will willingly pay for even relatively expensive foreign varieties in order to diversify their consumption. Second, producers differ in their costs of production. In other words, some firms are more productive than others. If trade is costly, because of either shipping costs or trade barriers, only a subset of lower-cost firms will generally be able to export because there will be no demand for the most expensive varieties abroad net of trade costs. It is argued that both of these features apply to a wide variety of industries.

A complete formal treatment of the model is provided in Appendix A, which demonstrates how to derive all of the model solutions for the case of a tariff. The original version of the model, in Melitz and Ottaviano (2008), employed a variable cost of trade, that is, firms must pay additional costs to export their products. These costs are treated here as a type of non-tariff barrier to trade. This paper explores firm preferences over trade policy for both tariffs and non-tariff trade barriers, so readers wishing to see derivations of the model solutions using the variable cost of trade should refer to the original paper. All of the results on trade preferences which follow this section are original to this paper, unless noted.

Two key features of contemporary trade: intra-industry trade and firm heterogeneity

Before describing the model, it is useful to introduce the literatures on intra-industry trade and on firm heterogeneity in exporting. These two features of modern international trade play a crucial role in developing the model and in understanding the results that follow.

Intra-industry trade occurs when a country both exports and imports the same product. This two-way trade in the same types of goods accounts for a significant portion of global trade flows although its extent varies from industry to industry. Intra-industry trade is usually defined as the overlap between import sales and export sales of the same good in a particular country (Grubel and Lloyd, 1971). Estimates vary based on data source and definition, but generally it is believed that roughly 25 to 50% of global trade is intra-industry and that this share has increased over time (OECD, 2002; Brülhart, 2009). This kind of estimate understates the analytic importance of intra-industry trade, however, because even asymmetric intra-industry trade flows will generate very different patterns for trade politics than uni-directional trade.

In the trade literature, intra-industry trade is generally explained as the consequence of an inherent desire for product diversity among consumers. This consumer 'love of variety' has several consequences. First, it gives rise to product differentiation, where firms specialize in niche varieties of a product in order to exploit the demand for variety among consumers. If firms are monopolists of their particular variety, as will be assumed here, they are capable of earning rents from this monopoly although they are still in competition with producers of other (imperfect) substitutes. Greater product differentiation also means that less efficient firms are more likely to survive the competition in their industry and remain profitable. Consumers will happily pay more for certain products if they value variety.

Relatedly, product differentiation changes the possibilities for firms engaged in international competition. If consumers place no value on differentiation, international trade is simply arbitrage, as goods travel from low-price locations to high-price locations. Trade between two countries in any given good flows in only one direction and countries are either import-competing or export-competing. With love of variety, trade can flow in both directions as countries can both import and export varieties of the same good. Even if a country is at a comparative disadvantage in the production of the differentiated product, foreign consumers may be willing to pay for its relatively expensive products to diversify their consumption.

The literature on firm heterogeneity in exporting is more recent, but has been linked with product differentiation from the start. The literature is now quite substantial, but three well-established empirical patterns identified in this literature play an important role in the model and the analysis that follows. First, almost all manufacturing industries have some exporting firms, including import-competing industries, while no industry is composed solely of exporters. Less than 50% of firms export in most export-competing industries (Bernard et al., 2007; Aw, Chung and Roberts, 2000; Delgado, Farinas and Ruano, 2002; Mayer and Ottaviano, 2008). Despite the fact that virtually all industries export a non-negligable proportion of output, variation in exporting is of course still linked to the traditional determinants of comparative advantage, notably relative labor-intensity and differences in technology (Bernard et al., 2007).

Second, firms which export have noticeably higher labor and total factor productivity and are consequently larger than non-exporters. This observation is the essential foundation of all of the major models of firm heterogeneity in international trade, but it of course raises the question of order of causation. The first generation of research on this question found strong support for self-selection into exporting by the most productive firms and relatively little evidence for learning-by-exporting (Clerides, Lach and Tybout, 1998; Bernard and Jensen, 1999; Aw, Chung and Roberts, 2000).[4]

Third, substantial reductions in tariffs at home and abroad are usually followed by considerable reallocations of production from less productive to more productive firms, partly because the latter grow larger due to increased export opportunities and partly because the former shrink or exit altogether due to more intense competition in the domestic market (Pavcnik, 2002; Tybout, 2003). The focus of economists has been on the welfare implications of reallocations of production to more productive firms, but from the perspective of trade politics, the most interesting implication is that trade liberalization has previously unrecognized distributional effects within industries.

With these two key concepts established, we can now turn to an outline of the model. Again, to facilitate the presentation and keep the focus on original material, the model is presented below in mostly non-technical terms. Readers who wish to see complete solutions to the model should refer to Appendix A or Melitz and Ottaviano (2008).

[4] Subsequent research suggests that there may be a noticeable positive effect of exporting on productivity, but still finds very strong self-selection into exporting, confirming that self-selection is the most important explanation (De Loecker, 2007; Van Biesebroeck, 2005; Lileeva and Trefler, 2007). At a more general level, there is a question here about the determinants of productivity differentials and the extent to which they are exogenous or endogenous to firm decision-making. For instance, it could be that in anticipation of entering the export market, firms invest heavily in capital and technology, while also 'trimming the fat', generating the empirical association between exporting and productivity. However, as long as the ability to do this differs across firms, the possibility of intra-industry divisions over trade remains plausible.

Consumers and love of variety

The economy in this model is comprised of two sectors. One sector features a group of firms each producing a distinct variety of a differentiated product. The varieties of the differentiated good are imperfect substitutes and consumers value diversified consumption. Production of any given variety is a global monopoly for a single firm but firms compete on price with one another to maximize profits. The second sector is a single homogeneous good which serves a primarily technical role (to fix wages at unity) and will not be a focus of analysis.

Each country is endowed with L units of labor, and these workers are also the only consumers in the economy. Each worker consumes q_i^c units of each differentiated good among the continuous measure of varieties indexed by $i \in \Omega$. Their total consumption of the differentiated good is therefore $Q^c = \int_\Omega q_i^c \, \mathrm{d}i$. There is also a homogeneous numeraire represented by q_0^c. Utility from consumption is defined as:

$$U = q_0^c + \alpha Q^c - \frac{1}{2}\eta Q^c - \frac{1}{2}\gamma \int_\Omega (q_i^c)^2 \, \mathrm{d}i.$$

The parameters α and η determine how much weight consumers place on the differentiated good relative to the numeraire. Of particular interest here is the final term, which penalizes over-consumption of any single variety and therefore leads consumers to spread their consumption across multiple varieties. The parameter γ therefore determines the extent of consumer love of variety. When love of variety is equal to zero, consumers place no value on consuming a differentiated basket of goods and care only about price. As love of variety increases consumers increasingly stress consumption of a broad array of varieties which allows relatively less efficient firms to survive despite their higher prices. In the model, love of variety also leads to intra-industry trade.

The utility function defined above is used to determine consumer demand for both domestic varieties and imports as a function of price. One important feature of the demand system is worth noting because it plays an important role in the next section. For each variety, there is a 'choke price' at which demand goes to zero. The least productive firms which enter the market will be forced to close up shop before they produce anything because there is no demand for their variety even if priced at marginal cost. Similarly, the least productive producers for the domestic market will not be able to export their variety abroad because there will be no demand for their variety once trade costs are factored into the price.

Producers and productivity

The productivity differences which the empirical literature identifies as the key explanation for variation in export performance are operationalized in this model as exogenous variation in each firm's constant marginal cost of production, c. Firms learn their productivity after they pay a fixed cost of entry, f_E, common to all firms in the same country. The marginal cost of production is assumed to be randomly drawn from a cumulative distribution function G with support on $[0, m]$. m is therefore the marginal cost of the least productive potential producer. It is assumed that m is sufficiently high so that some high cost firms will not be able to profitably produce for either the domestic or export market, and so will produce nothing in equilibrium.

It is now useful to begin superscripting parameters and endogenous variables to allow asymmetries between two countries l and h. All assumptions and results will be written in terms of l, and the analagous forms for h will be omitted to preserve space. I will allow the countries to vary by size (L^l), the distribution of productivities (G^l), their fixed costs of entry (f_E^l), and their trade policies.

Two policy instruments are explored here: an *ad valorem* tariff, τ, and a non-tariff trade barrier, ν. For example, ν^l is a variable cost of trade paid for by a firm exporting from h to l. The cost of one unit of production exported from h to l is $\nu^l c$, so more productive firms have lower trade costs. This cost-of-trade will be referred to as a non-tariff barrier to trade throughout. τ^l is a tariff paid by consumers importing a good from h to l. It is multiplicative of the price set by foreign producers, so if the firm sets the price at p_f^l then consumers in h must pay $\tau^h p_f^l$. These two trade instruments will be referred to jointly as 'trade barriers'.

As noted previously, the demand system leads to a choke price above which there is no demand for a given variety. In the domestic market, there will be a marginal cost above which no firm is able to profitably sell their good at home. This *domestic productivity cutoff* is also the choke price in the domestic market, and is represented by c_D^l. Any firm in l whose marginal cost is greater than this cutoff will find no demand for their variety, even if it is priced at unit cost, and will drop out of the market. Firms which wish to export to l will face the same choke price, but note that they face additional barriers to entry in the form of tariff or non-tariff barriers. For this reason, the *export productivity cutoff* for firms in h is $c_X^h \equiv \frac{c_D^l}{\tau^l}$.[5] Any

[5] This equivalency is not obvious, but is proven for both the tariff and NTB case in Appendix A.

firm with a marginal cost of production higher than the export productivity cutoff will not be able to export abroad. Note that these cutoffs are still undetermined at this point.

The cutoffs end up playing a fundamental role in the analysis of the model. Prices, sales and profits in both the domestic and export markets are a function of the firm's marginal cost and the cutoffs:

$$
\begin{aligned}
p_D^l(c) &= \frac{1}{2}(c_D^l + c) & \qquad p_X^l(c) &= \frac{\tau^h}{2}(c_X^l + c) \\
q_D^l(c) &= \frac{L}{2\gamma}(c_D^l - c) & \qquad q_X^l(c) &= \frac{L^h}{2\gamma}\tau^h(c_X^l - c) \\
\pi_D^l(c) &= \frac{L}{4\gamma}(c_D^l - c)^2 & \qquad \pi_X^l(c) &= \frac{L^h}{4\gamma}\tau^h(c_X^l - c)^2.
\end{aligned}
$$

For a firm with marginal cost equal to the cutoff, the domestic price is equal to marginal cost and sales are equal to zero. Prices are lower, and sales and profits are greater for more productive firms. This replicates the observed pattern that more productive firms are larger, more profitable and export more.[6]

It is also worth commenting on the crucial role that the cutoffs c_D^l and c_D^h play as indicators of the extent of competition. Melitz and Ottaviano (2008) show that an economy with a lower cutoff has lower average prices, lower average markups over cost, and lower profits per firm. The domestic cutoff is therefore closely tied to the idea of the 'competitiveness' of the differentiated sector, and throughout, lower cutoffs are considered synonymous with greater competition. Relatedly, we will make use of the average price in autarky as closely akin to the concept of compar-

[6] Note also that p_X^l represents the price paid by the consumer and firms only earn $p_X^{fl} = \frac{p_X^l(c)}{\tau^h}$ in the tariff case.

ative advantage. Because the homogeneous good is a numeraire, if l has a lower average price in autarky, which is equivalent to $c_D^l < c_D^h$, then it will be more competitive when the economies open up to trade. Although these average price ratios are not exactly in line with the orthodox definition of comparative advantage, I will refer to them as comparative advantages because of the very close analogy and to economize on language.

Short and Long-run Equilibria

All that remains is to find solutions for the productivity cutoffs and determine the number of firms serving each market. In order to do this, it is necessary to choose a time horizon for an equilibrium. This paper uses both long- and short-run equilibria, but in a specific way. Long-run equilibria, which feature a complete process of firm entry, are used to establish the productivity range and number of firms serving each market *before* any policy change. Transitions to short-run equilibria, with this set of firms, are then used to determine firms' preferences over trade policy. The reasons for this choice are described in the next section.

Determining analytic solutions for the cutoffs also requires specifying a distribution of firm productivities. Following much of the literature on firm heterogeneity and the original model, it is assumed that costs are distributed Pareto i.e. that $G^l(c) = (\frac{c}{m^l})^{k^l}$ for $c \in [0, m^l]$. For the moment, I also assume that $k^l = k^h = k$ while permitting m^l and m^h to differ. The Pareto distribution has been shown repeatedly to be a reasonable approximation of the empirical distribution of firm productivities within specific industries (Gatto, Mion and Ottaviano, 2006; Luttmer, 2007).

It is also analytically convenient, generating straightforward solutions for the key productivity cutoffs. Appendix A provides a complete description of the explicit solutions for the cutoffs and for the number of firms entering and serving each market.

This section has introduced the model of the economy upon which all of the results in the next few sections are based. Two key features of the model were highlighted. Consumers value consuming a variegated set of product varieties. Because of this, countries generally import and export the same good, leading to intra-industry trade. Not all firms are equally adept at exporting, however. More productive firms have lower prices, and so are more equipped to find positive demand abroad, once costs of trade are factored in. Firms with higher costs must charge higher prices to earn a profit, and may face no demand for their variety abroad. The next section explains how this model can be used to develop a theory of firm preferences over trade.

Evaluating Preferences at the Firm Level: When Does the Theory Apply?

With the model of firm heterogeneity developed by Melitz and Ottaviano (2008) in hand, it is now possible to develop a series of claims about preferences over trade liberalization at the firm level. Before getting to these results, however, it is important to define some terms and explain the conditions under which the theory is expected to apply. In particular, this section makes the case for an alternative to the

Ricardo-Viner and Stolper-Samuelson approaches to trade politics by discussing firm-specific capital, the appropriate time horizons for analysis, and the question of firm-specific protection.

First, some definitions: a bilateral trade liberalization is defined as some change in tariffs $\{\tau_0^l, \tau_0^h\} \rightarrow \{\tau_1^l, \tau_1^h\}$ for which $\tau_0^l < \tau_1^l$ and $\tau_0^h < \tau_1^h$. It is assumed that a firm's productivity remains constant over time. In the special case of the move from autarky to (costly) trade, which heuristically we can denote $\{\tau_0^l = \infty, \tau_0^h = \infty\} \rightarrow \{\tau_1^l, \tau_1^h\}$, I will generally omit the subscript and refer to the post-liberalization tariffs as $\{\tau^l, \tau^h\}$.

> **Definition 1** A supporter of a given trade liberalization is any firm for whom $\pi(\tau_1^l, \tau_1^l) > \pi(\tau_0^l, \tau_0^h)$, that is, any firm whose profits are greater in the equilibrium which prevails after the policy change than in the pre-policy change equilibrium. Opponents are those whose profits decrease after the change in trade policy.[7]

The owners of firms are not treated as consumers and their welfare is evaluated solely based on changes in profits.[8]

A number of conceptual and definitional issues arise in trying to apply models of trade with firm differentiation to the study of trade politics:

Firm-specific capital Definition 1 raises the question of asset specificity, an issue which has been at the center of the trade politics literature (Rogowski, 1989; Frieden, 1991; Hiscox, 2001). In standard trade models, whether assets are tied to their current industry of occupation or are freely mobile determines whether divisions over

[7] This definition has been phrased in terms of tariff reductions but the definition of a supporter of reductions in trade costs, $\{\nu_0^l, \nu_0^h\}$, is equivalent.

[8] This assumption is becoming a standard simplification. See Abel-Koch (2010), who notes a similar approach in Bombardini (2008).

trade policy will occur between industries (as in the Ricardo-Viner model) or between broader coalitions of factor owners (as implied by the Stolper-Samuelson theorem). The approach here diverges from both of these perspectives by assuming that assets are firm-specific, and immobile even within the same industry. Within the context of the model, firm-specific capital is a sunk cost, a ticket to see one's productivity draw only and so completely immovable and unrecoverable.

This approach builds off much of the literature in industrial organization on firm entry and exit, which emphasizes the extent of unrecoverable investments. These may include: labor force training; product and production process development; advertising and branding; and, product-specific capital (Mata, 1991; Clark and Wrigley, 1995). These sunk costs may be especially important in industries producing differentiated products. Partially recoverable investments also take time to repurpose or sell, and these endeavors require additional expenditure (Albuquerque and Rebelo, 2000). The model presented here is therefore most applicable for the short- or medium-term or over longer time horizons when capital is truly a sunk cost.

The short-run The long-run version of the model involves a complete process of firm entry in which firms only learn their productivity after the trade policy has been determined. While firms may, *ex post* the revelation of their productivity, wish that a different trade policy had been instituted, that information is of little use *ex ante* when the trade policy is still up for debate. This paper therefore concentrates on transitions from long-run to short-run equilibria. This ensures that the extant set of firms is fully endogenized and that the process by which those firms reason about preferred policies is well posed. Nonetheless, most of the results in the paper are also applicable to transitions to long-run equilibria. Where significant differences arise, they will be footnoted.

No variety-specific protection Another key issue raised by this literature concerns whether trade protection is available to specific firms or varieties, or whether it remains a public good for all firms in the industry (Gilligan, 1997). The model used here, and indeed most of the models in this literature, assume that firms monopolize a single variety and no other firms at home or abroad produce exactly the same variety. This means that any trade barrier to a specific foreign variety benefits all domestic firms (and one domestic firm's benefit from the trade barrier does not preclude another firm from benefitting) so trade protection is similar to a public good.[9] Bombardini and Trebbi (2012) also assumes that firms can lobby for variety-specific protection and provides evidence that this mode of lobbying may be more prevalent in industries producing differentiated products. At this point it remains an open question whether the public- or private-good view of trade protection is a more accurate picture for industries producing differentiated products and there is a need for more research on this question.

Product differentiation A key conjecture of this paper is that firm heterogeneity in exporting, even when combined with firm-specific capital, is not sufficient to gen-

[9] For a trade model with a different perspective, see Bernard et al. (2003), which features Bertrand competition at the global level among firms who each have potential competitors in other countries producing the exact same variety. Because firms are also competing with the other varieties for market share, trade policy has both excludable and non-excludable aspects.

erate intra-industry divisions over trade liberalization. In a competitive market for a homogeneous product, a firm's production (and profits) are determined by the price of their product, factor prices and the firm's production function. As long as all firms in an export-oriented industry use similar factor proportions, then all firms face the same forces after a reduction in tariffs in the export market. Costs change (but they pay the same prices because they all produce domestically, and use similar factor proportions) and the price of their good changes (but they all earn the same world price, regardless of whether they export, because its a homogeneous good). All firms either gain or lose profits together, then, depending on the balance of these changes.[10] Product differentiation is the crucial extra factor for two reasons. First, it permits heterogeneity in pricing across firms which determines export status. Second, it generates intra-industry trade, which generally increases competition in both markets, ensuring that domestic-only firms lose from trade liberalization.

Firm Preferences over Trade Liberalization

What firms support trade liberalization and under what circumstances? This question is examined under two different scenarios. The first explores the preferences of firms over a bilateral, although not necessarily equal, trade liberalization

[10] If, however, we alter the assumption that firms use the same factor proportions then it might be possible to generate intra-industry divisions over trade liberalization. Note however that any reallocations have nothing to do with whether the output is exported or not. For this reason, it is also argued that firm heterogeneity is not necessary for intra-industry divisions over trade.

in an economy which is completely closed off to international trade. The second examines situations when economies are already partially open to trade and a mutual reduction in trade barriers or tariffs is proposed.

Each of these cases requires careful attention to the distributional implications of trade liberalization. The first step in either case is to pin down patterns of exporting, domestic production and exit. Three propositions are then presented which answer the following questions: Which firm gains the most from trade liberalization, if any? Under what circumstances will no firms support trade liberalization? What set of firms supports trade liberalization and how does their support depend on their productivity? Important differences emerge in the answers to these questions depending on whether the pre-liberalization environment is autarkic or partially open.

Autarky to Free Trade Case

Intra-Industry Divisions

In this section, transitions from a complete lack of international trade to an open economy are examined, for both the tariff and non-tariff barrier cases. The first step in exploring the distributional implications of opening the economy to trade is determining which firms will export, which will produce only for the domestic economy and which will drop out. All of the results which follow are proven in Appendix A1.

In a setting with intra-industry trade, it is intuitive that opening up the economy to trade should increase competition in the domestic market. In terms of the cutoffs, this increased competition is synonymous with $c_D^l < c_A^l$. Still, we might wonder how robust this intuition is to highly asymmetric trade liberalizations, or trade liberalizations between countries of vastly different sizes or productivity distributions. It turns out to be completely robust to any country asymmetries. The next question is whether exporters will be only a subset of the complete range of producers for the domestic market after liberalization, replicating the observed pattern in the real world. In terms of cutoffs, this means that $c_X^l < c_D^l$. This relationship will hold as long as both countries have a positive level of trade barriers after liberalization has occurred.

We can therefore specify the complete ordering of cutoffs in both countries without making any restrictions on the set of possible liberalizations:

$$0 < c_X^l < c_D^l < c_A^l.$$

Opening up the economy to trade thus has two major effects. First, it increases competition in the home market. The least productive firms whose marginal cost exceeds the domestic productivity cutoff after liberalization are forced to drop out. There is no demand for their high-priced products now that consumers have access to cheaper foreign varieties. All firms which remain in the market face reduced profits from domestic sales relative to autarky.[11] Second, those firms with marginal cost below the exporting productivity cutoff are now capable of profitably exporting. They in turn displace inefficient domestic producers in their export market. Note that both countries will have firms which export.

[11] This holds because $c_D^l < c_A^l$, and therefore $\pi_D(c) - \pi_A(c) = \frac{L^l}{4\gamma}(c_D^l - c)^2 - \frac{L^l}{4\gamma}(c_A^l - c)^2 < 0$ for any c.

We earlier defined opponents of trade liberalization as firms whose profits are reduced after liberalization. At this point, then, we can clearly identify as opponents of the move to trade all non-exporters. Establishing the existence of intra-industry divisions over trade policy also requires identifying a range of productivities that have increased profits after liberalization. Doing so will be facilitated by the following proposition:

> **Proposition 1a** On the range $[0, c_X^l]$, the percentage change in profits relative to autarky is decreasing in c. If any firm benefits from opening the economy to trade, the absolute change in profits is greatest for the most productive firm and $\Delta\pi^l(c)$ is decreasing in c near $c = 0$.

This proposition, which is proven in Appendix A2, has practical and substantive interest. Substantively, it demonstrates that the largest, most productive firms are the greatest beneficiaries from trade liberalization in both percentage and absolute terms. This provides a clear indication of the distributive consequences of trade liberalization when an economy is opened to trade for the first time. It also suggests that the 'intensity' of support for trade liberalization will vary systematically with firm productivity. The biggest firms have the most to gain, and so should push the hardest for trade liberalization.

At a practical level, this proposition implies that if we are looking for a winner from trade liberalization, than we should examine the exporters at the most productive end of the distribution of marginal costs.[12] Will there always be a supporter of trade liberalization, no matter how different the countries or unequal the trade con-

[12] It will prove useful throughout to focus on a firm with productivity $c = 0$. This may seem odd, because the Pareto density equals zero at $c = 0$. However, if we can demonstrate that the change in profits for a firm with $c = 0$ (symbolically, $\Delta\pi(0)$) is strictly greater than zero, than there must

cessions? Unsurprisingly, the answer to this question is no. However, examination of a wide range of cases using numerical simulation suggests that intra-industry divisions are the rule rather than the exception, occurring in more than 94% of simulations across a wide grid of parameter values featuring significant asymmetries between the countries. These simulations are described in more detail in Appendix B1.

Under what circumstances will all firms in l oppose trade liberalization? Several results are available. First, the profits of l's firms are diminishing in their trade barriers after liberalization. Pushing down these barriers sufficiently may ensure that no firms benefit from trade liberalization, although there is no guarantee because there are still gains abroad for exporters. As h's tariffs increase, l's exporters lose profits in their export market, and this will suffice to ensure that no firms support trade. Second, if either the Ricardian comparative advantage of h's firms is high enough or the fixed costs of entry in h are low enough, then it is possible that no firm in l will benefit from trade. Either of these conditions makes l's firms more competitive as exporters, and the foreign market harder to break into.

These ideas form Proposition 2a and are proven in Appendix A3.

> **Proposition 2a** If h's tariffs are sufficiently high then no firm in l supports trade liberalization. Likewise, if h's firms are sufficiently efficient or their costs of entry sufficiently low. Reductions in l's non-tariff barriers or tariffs also reduce the profits of all of its firms, and so may lead to no firm in l supporting trade. Finally, if h's market is sufficiently large, no firm in l supports trade liberalization.

This result provides some important clues for how to interpret the significance of

be some range of productivities $c \in (0, \tilde{c}]$ as $\tilde{c} \to 0$ for whom $\Delta\pi(c) > 0$. This is so because the function $\Delta\pi(c) = \pi^l_X(c) + \pi^l_D(c) - \pi^l_A(c)$ is continuous and defined everywhere on $c \in [0, c^l_X]$.

firm heterogeneity in exporting for trade politics. Divisions over trade are common, but they are not guaranteed to occur. Industries can be united on trade, even if some firms export and some do not. The traditional determinants of competitiveness, like technology differences and barriers to entry, still play an important role in shaping the industry's stance toward trade. Firms will be united in opposition if the trade partner is too competitive or if their country concedes too much in trade negotiations without gaining sufficient access abroad.

Does the productivity of l's firms have an impact on whether there will be a supporter of trade? Yes, but not in a straightforward manner. Consider two cases involving tariffs. If l makes significant reductions in tariffs and h relatively small reductions, then l's firms strongly oppose trade liberalization if they are unproductive. They would prefer to operate in the uncompetitive autarkic environment. The likelihood of no supporters is therefore increasing in 'uncompetitiveness'. If, however, h makes substantial cuts in tariffs and l reduces tariffs very little then l's firms continue to operate in a quasi-autarkic environment at home. A reduction in competitiveness is therefore a good thing. What happens in the export market? Recall that because of Proposition 1a, we only need to consider the most productive firm. They might actually benefit from less competition from their compatriot firms in the export market and so the likelihood of no supporters can actually be *increasing in domestic competitiveness*. This result highlights, not for the last time, the special care which is required to understand the preferences of high-productivity exporters.[13]

[13] This argument, and the discussion in the next paragraph, are formalized in Appendix A3.

A similar interaction occurs between the productivity of l's firms and the productivity of h's firms. If h's firms are extremely productive on average, then the change in profits of the most productive firm brought about by trade liberalization is increasing in home country productivity. Intuitively, with significant competition abroad, the losses associated with opening up to trade are greatest when domestic competition in autarky is weak. In contrast, if h's firms are extremely unproductive, the change in profits of the most productive firm is decreasing in home country productivity. When foreign producers are extremely inefficient, the main impact of trade liberalization is that it provides access to a new market abroad. Highly productive firms gain the most from this new access when the other firms in their country are relatively inefficient.

Finally, note that there are differences between the tariff and non-tariff barrier case. The reasons relate to the argument just made: that highly productive producers can benefit from a small level of NTB's which block out compatriot firms. This will be discussed in depth in the next section.

Which Firms Support an Open Economy?

We can now identify which firms will support and which firms will oppose a given trade liberalization. First, recall that because trade liberalization enhances competition in the domestic market, a subset of firms which produced in autarky is forced to drop out once the economy opens up to trade. Because these firms had positive profits in the autarkic equilibrium, they are naturally opponents of any trade liberalization which pushes their profits to zero. Similarly, firms which service only the domestic market will oppose trade liberalization because an open economy is more competitive, and these firms are not able to take advantage of export opportunities abroad to compensate for market share lost at home. Therefore, we must look to exporters to find the complete range of supporters of free trade.

It must be the case that the marginal exporter ($c = c_X^l$) *opposes* opening the economy to trade: they only just earn positive profits from exporting, while they of course lose market share at home. Moreover, there will be a range of exporters who earn positive profits from exporting who are opposed to trade liberalization. These will be the least productive exporters who cannot find a large enough market for their variety abroad to compensate for their losses in the domestic market. Of course, we also know that the most productive exporters will gain from opening up the economy to trade, if any firm does, so we need to determine the number and locations of the 'breaks' in the productivity distribution which separate supporters and opponents of trade. Appendix A4 contains a proof that there is one (and only one) division between supporters and opponents of trade. This means there is a clear dividing line between winners and losers from trade in the range $(0, c_X^l)$. We can define it implicitly as follows:

Definition 2 The pro-trade productivity cutoff is the productivity c_{PT}^l such that

$$\pi^l(c_{PT}^l, \tau^l, \tau^h) - \pi^l(c_{PT}^l, \infty, \infty) = 0.$$

Any firm with $c < c_{PT}^l$ supports the trade liberalization; any firm with $c > c_{PT}^l$ opposes the trade liberalization. If there are no supporters of of the trade liberalization, then c_{PT}^l is not defined.

This division of the industry into pro- and anti-trade blocs is summarized in

Proposition 3a.

Proposition 3a The following ranges of supporters are possible:

1. All firms in the range $(0, c^l_{PT})$ where $c^l_{PT} < c^l_X$.
2. No firms support trade liberalization.

At this point, it is worth mentioning an important consequence of unpacking the industry to look at the firm: most firms are neither intrinsic supporters nor opponents of trade. As was already shown, no firm will support trade liberalization if its own country makes concessions that are too steep or if its competitors are too efficient. Moreover, the dividing line between supporters and opponents, defined by c^l_{PT}, is a function of the parameters. Later on it will be shown that c^l_{PT} is increasing in home country trade barriers and decreasing in foreign country competitiveness. It is therefore possible that the same firm will change opinions on a trade deal if their country is forced to make extra concessions. It is also possible that a firm will support a trade deal with one country and not with another, even if it is capable of exporting to both.

All of the results so far are summarized in Figure 2.1, which plots profit as a function of marginal cost both in autarky and after a trade liberalization, as well as the difference between the two. In the example on the left, an economy moves from autarky to costly trade, and there is a continuous range of supporters of trade among the most productive exporters. The most productive firms have the greatest gains from trade, too. The second example on the right shows a situation in which no firm benefits from opening up to trade. In order to generate this example, I reduced the country's tariffs post-liberalization and increased its trade partner's average productivity.

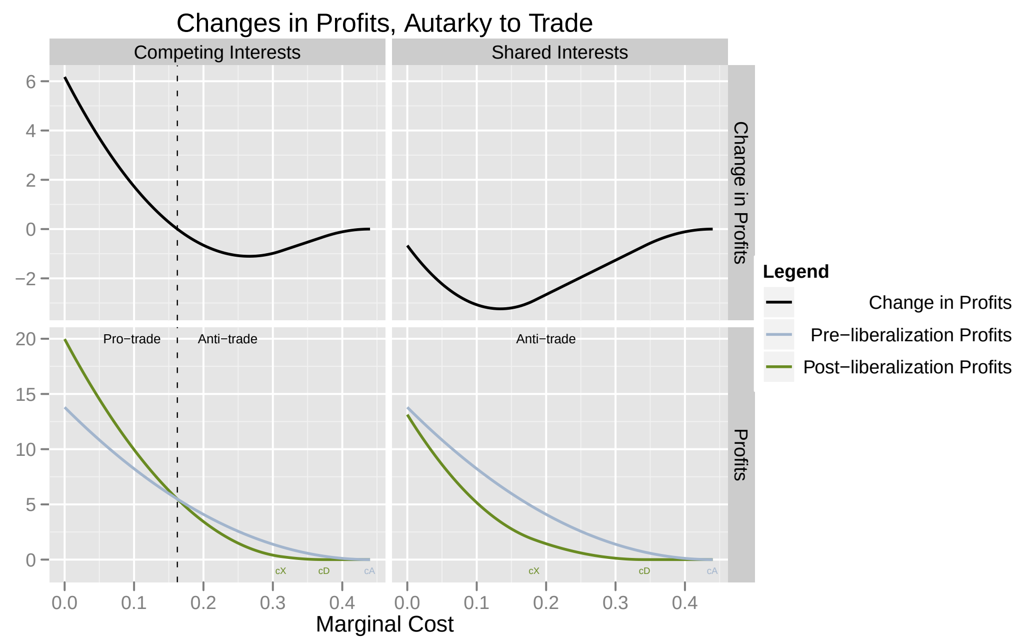

Figure 2.1: Some trade liberalizations will feature intra-industry divisions over trade, particularly those which are relatively equal. Others will feature complete opposition from the country, especially if its relative concessions are too great or if the other country has a significant comparative advantage in the production of the differentiated good. Both examples feature completely equal parameterizations between the two countries except for the productivity distribution and the trade policy. On the left, $m^l = m^h = 1.5$ (the profits of l's firms are shown) and $\tau^l = \tau^h = 1.2$. For the right, $m^l = 1.5$, $m^h = 1.2$, $\tau^l = 1.2$ and $\tau^h = 2$.

This section has proven three results on firm attitudes toward trade when two economies open up to trade with one another for the first time. The economy is generally split between a group of productive exporters who support trade and a group composed of unproductive exporters and domestic-only firms which oppose trade. The greatest beneficiary from trade liberalization is also the largest, most productive firm. However, if trade concessions are too asymmetric or foreign competitors too competitive, it may be that no firms support trade liberalization. Turning to the case of trade liberalization between two countries who already engage in some trade, the first two of these results will be sharply different.

Restricted to Freer Trade Case

I now turn to the case of proposed trade liberalizations in an already partially open economy. The equilibrium before the policy change is represented symbolically by a 0 subscript, while the equilibrium after trade barriers are reduced is represented with a 1. The section develops three propositions which parallel those presented in the autarky-to-trade case. The firm which gains the most from trade liberalization will be identfied first, and then the circumstances under which no firms benefit from trade liberalization will be outlined. Finally, the possible patterns of support and opposition to trade liberalization will be presented. The first and the last of these results will diverge from those in the autarky-to-trade case, illustrating the importance of a close examination of the distributional effects of trade.

Intra-Industry Divisions

Will the industry producing the differentiated product be divided over trade liberalization as before, with the most productive exporters supporting trade? Will the most productive exporters be the greatest winners from trade? Before answering these questions it will be useful to again order all of the cutoffs in country l to clarify the distributional stakes. We already know that any reduction in trade barriers increases competition in the domestic market, and it has already been shown that only the most productive firms export. Appendix A1 contains a proof that exporting becomes easier in the foreign market for any liberalization, completely ordering the cutoffs:

$$0 < c^l_{X0} < c^l_{X1} < c^l_{D1} < c^l_{D0}.$$

This ordering is nearly assumption free, requiring only that consumers in both countries consume both the differentiated good and the numeraire.[14]

This ordering summarizes the major effects of a reduction in trade barriers in an already open economy. Competition increases in the domestic market. A group of the least competitive firms are forced out of the market completely while all other

[14] Will this same ordering hold in the long run? Appendix A1 shows that it will except for an important set of exceptions. Extremely asymmetric liberalizations (such as a unilateral liberalization) can lead to a change in cutoffs such that $c^l_{D1} > c^l_{D0}$, as originally show in Melitz and Ottaviano (2008). The logic here is that if one country lowers trade barriers unilaterally, firms have a new incentive to relocate to the non-liberalizing country. They can then produce for that market, and export back to the now relatively more open economy. The appendix also interprets the condition that $c^l_{D1} < c^l_{D0}$ for the long run case, showing that it assumes either negotiated reductions in trade barriers, or country productivities, aren't 'too asymmetric'.

firms which continue to produce face a tougher domestic market. However, a mutual reduction in trade barriers also implies that a greater range of producers will be able to export post-liberalization, while all extant exporters will continue to serve the foreign market.

With this ordering we can return to the question of the existence of intra-industry divisions over trade. As in the case of moving from autarky to the open economy, it is easy to identify opponents to trade liberalization: any firm which produces solely for the domestic market will oppose trade liberalization because it enhances competition in the domestic market.

We will look again at the the most productive firm which has marginal cost equal to zero, but Proposition 1b immediately makes clear that this may not lead to a reliable set of supporters of trade liberalization.

> **Proposition 1b** Among the firms which export post-liberalization, the firm with the greatest increase (or smallest decrease) in profits from trade liberalization is *not* the most productive firm, and $\Delta\pi^l(c)$ is increasing in c near $c = 0$.
>
> If any firm benefits from trade liberalization, the greatest percentage increase in profits does not accrue to the most productive firm, and the percentage increase in profits is increasing in c near $c = 0$.

See Appendix A2 for a proof. Note that the most productive firm is also the largest firm and the greatest exporter pre-liberalization, so this result challenges the instinct that big, successful exporters are the greatest beneficiaries of trade liberalization. This also contrasts sharply with the autarky-to-trade case discussed in Claim 1a where the largest, most productive firm was the most intense supporter of trade liberalization. Exploring the NTB and tariff case in turn makes clear what is going on.

Unlike in the autarky-to-trade case, the most productive firms are *opponents* of reductions in non-tariff trade costs under all conditions.[15] Consider the forces unleashed by trade liberalization for highly productive firms when costs of trade vary with productivity. On one hand, trade liberalization lowers the profit-maximizing price of the exporter's variety in the foreign market via a reduction in costs paid by the firm. On its own, this reduction in costs would increase profits as sales grow in the foreign market and a greater share of the price is pocketed by the firm per unit sold. However, trade liberalization also enhances competition in both of the markets in which the exporter sells. In the home market, more foreign varieties are available which intensifies competition and reduces domestic profits. In the foreign market, an extant exporter faces greater competition from its compatriot firms who now have greater access abroad. For the lowest cost firms, the benefits of reduced trade costs are exceeded by losses due to intensified competition at home and abroad.

Examination of the tariff case makes clear that this logic is not just a feature of the variable cost-of-trade. Appendix A5 uses the long-run case to derive a set of conditions under which the most productive firms will not favor reduced tariffs.

[15] The change in profits for this firm is:

$$
\begin{aligned}
\Delta\pi^l(0) &= \frac{L^h}{4\gamma}(\nu_1^h)^2(c_{X1}^l)^2 + \frac{L^l}{4\gamma}(c_{D1}^l)^2 - \frac{L^h}{4\gamma}(\nu_0^h)^2(c_{X0}^l)^2 - \frac{L^l}{4\gamma}(c_{D0}^l)^2 \\
&= \frac{L^h}{4\gamma}(c_{D1}^h)^2 - \frac{L^h}{4\gamma}(c_{D0}^h)^2 + \frac{L^l}{4\gamma}(c_{D1}^l)^2 - \frac{L^l}{4\gamma}(c_{D0}^l)^2 \\
&< 0
\end{aligned}
$$

Note that if the inequality is strict, this implies that there are some highly productive firms with positive marginal cost of production who also lose from trade liberalization.

(Although these results are mostly not available for transitions short-run equilibria, much of the intuition carries over.) For example, the most productive firms will oppose a bilateral reduction in tariffs if their own country's post-liberalization tariffs are too low relative to their pre-liberalization tariffs. Symmetrically, they will oppose any trade liberalization for which their trade partner's reductions in tariffs are not great enough. They will also oppose freer trade if their own country's firms are sufficiently efficient compared to the firms in the foreign country, reflecting their competition with less productive domestic exporters.

Why would the most productive firms, in particular, gain less from reductions in tariffs? This occurs because the most productive firms have the lowest prices, and so the reduction in *ad valorem* tariffs creates a lower total decrease in prices (and a lower increase in quantity sold) than for a less productive firm within this model's linear demand system. At the same time, the most productive firms are the most exposed to the foreign market and so take a greater hit from enhanced competition in that market. As the outlines of the trade liberalization become more unfavorable to l, the firms at the low end of the cost distribution are therefore the first big exporting firms to be submerged into losses from the reductions in trade barriers.

The next step is to examine whether there will be supporters of trade liberalization (we already know that domestic-only firms and the least productive exporters will oppose trade liberalization). As in the autarky-to-trade case, there will be conditions under which no firms benefit from trade liberalization. If either tariffs or NTBs are reduced too much in the home market, no firm will benefit from trade liberalization. If tariffs aren't reduced sufficiently in the foreign market, no firm will benefit from trade liberalization (but no clear analytic result is available for the NTB case). Note also that even if a liberalization has no supporters in some country, there will still be firms which are profitably exporting. The gains in the foreign market simply aren't great enough to compensate for the losses at home.

These ideas are all proven in Appendix A3 and lead to Proposition 2b.

> **Proposition 2b** If h's post-liberalization tariffs are sufficiently high, then no firm in l supports trade liberalization. Reductions in l's post-liberalization non-tariff barriers or tariffs also reduce the profits of all of its firms, and so may lead to no firm in l supporting trade liberalization.

This is a relatively spare set of results, but with good reason. Most of the parameters affect the level of competition in both markets, and both before and after liberalization. For example, an increase in the competitiveness of h's firms reduces cutoffs in both countries before and after liberalization. For any given firm, this means that both the pre-liberalization and post-liberalization environments are less appealing. The exact effect of changes in competitiveness therefore depends crucially on the matrix of trade policies which characterize the environment before and after liberalization.

Which Firms Support Trade Liberalization?

We have already established that all non-exporters after liberalization are opponents of greater trade. So we can focus on the range of post-liberalization exporters to look for supporters of trade. We also know that there will be instances where the most productive firms support trade liberalization, and instances where they oppose it. The key question is whether the range of supporters, if it exists, will be continuous. Appendix A4 contains a proof that it is, and this allows us to define the pro-trade productivity cutoffs and make Claim 3b.

Definition 3 The pro-trade productivity cutoffs (restricted trade to liberalized trade case) are the productivities $\underline{c}^l_{PT}$ and $\bar{c}^l_{PT}$ (with $\underline{c}^l_{PT} < \bar{c}^l_{PT}$) such that

$$\pi^l_1(\underline{c}^l_{PT}, \tau^l_1, \tau^h_1) - \pi^l_0(\underline{c}^l_{PT}, \tau^l_0, \tau^h_0) = 0$$

and

$$\pi^l_1(\bar{c}^l_{PT}, \tau^l_1, \tau^h_1) - \pi^l_0(\bar{c}^l_{PT}, \tau^l_0, \tau^h_0) = 0$$

If $c = 0$ supports the trade liberalization, than $\underline{c}^l_{PT} = 0$, and if no firms support the liberalization than the pro-trade cutoffs are undefined.

Proposition 3b The following ranges of supporters are possible for each trade instrument:

1. A reduction in non-tariff barriers: either $0 < \underline{c}^l_{PT}$ and $\bar{c}^l_{PT} < c^l_{X1}$; or, no firms support trade liberalization.
2. A reduction in tariffs: either of the patterns from 1; or, if the terms of the liberalization are sufficiently favorable, $\underline{c}^l_{PT} = 0$ and $\bar{c}^l_{PT} < c^l_{X1}$.

The most noteworthy feature here is the non-monotonic relationship between productivity and support for trade liberalization. Because the most productive firms can benefit from increases in trade barriers, given the right circumstances, they may find themselves sharing the interests of the least productive firms which have no ability to export whatsoever. The contrast with the autarky-to-trade case, where the most productive exporters usually have an interest in greater liberalization, is also striking and points toward several broader points.

First, opening the black box of the industry reveals complex dynamics associated with trade liberalization at the firm-level, and non-obvious conclusions about the likely preferences of firms over trade. Second, firms which are better equipped at jumping over trade barriers may not have an interest in reducing those trade barriers. Competitors from their home country may benefit more and even displace them in foreign markets. The simple equation of exporting with an interest in freer trade is not supported in this context. Finally, extant exporters start to take on the attributes of firms actually located in their export market. As a simple case, consider a one-time only adjustment cost for exporting to a country. Extant exporters, having already paid that cost, have no interest in it being lowered for anyone else.

Finally, claims 1b, 2b and 3b are summarized graphically in Figure 2.2, which plots the profit functions before and after trade liberalization for a hypothetical country moving from restricted to freer trade across a number of scenarios.

Exporters and Unilateral Increases in Trade Barriers

The focus on firm opposition to trade liberalization at the highest end of the productivity spectrum in the previous section naturally implies that such firms can benefit from a mutual increase in trade barriers or tariffs by both countries. But it turns out that in the case of non-tariff barriers to trade we can make a much stronger statement: the most productive exporters can actually benefit from a unilateral increase in non-tariff barriers in their export market, as long as the market remains at least partially open to trade. Over the short run, a unilateral increase in non-tariff barriers has two effects on firms exporting to that market. It makes it harder for firms to export to the market because their products will be more expensive, but it also reduces the overall level of competition in the market. For the lowest cost

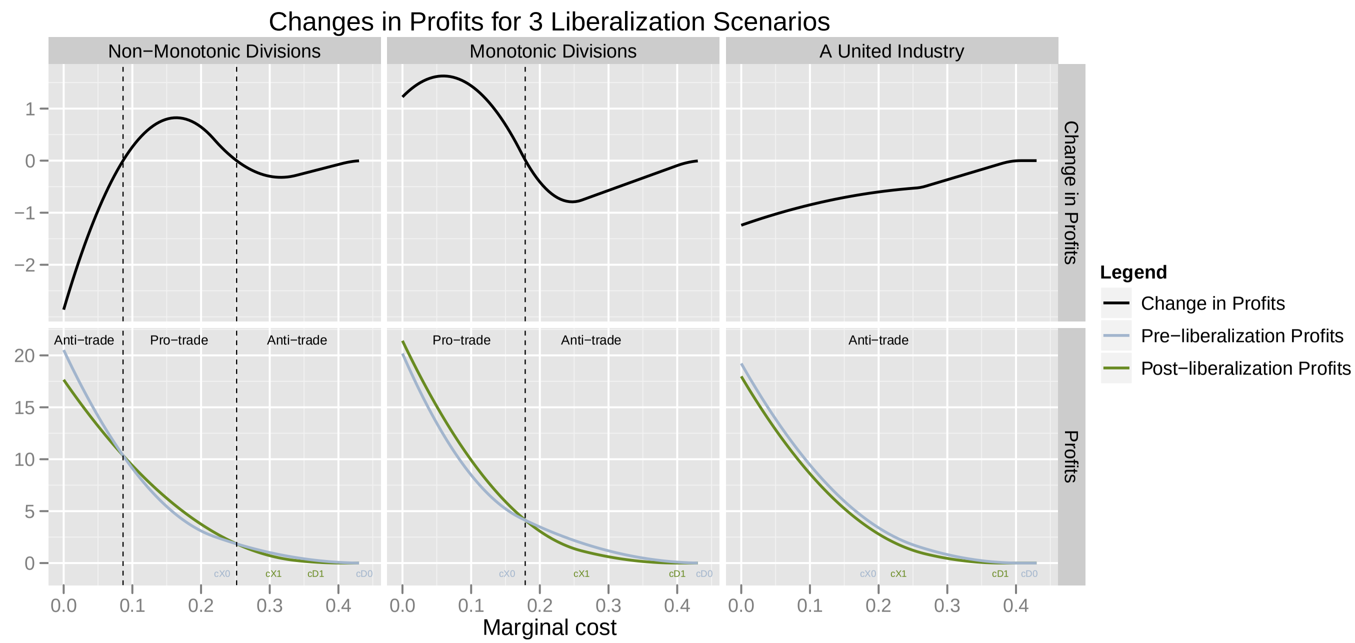

Figure 2.2: All long-run equilibria feature a range of supporters and opponents to trade, as shown in the two left-most examples. In the tariff case, it is possible that either the most productive exporters favor or oppose trade liberalization, while in the NTB case they always oppose. In any case, note that the greatest benefits of trade do not accrue to the largest or most productive firm. As in the move from autarky to trade, some short-term equilbria feature no supporters of trade, as on the right. This can occur, for example, if a country agrees to lower its tariffs or trade barriers too sharply. On the left, $m^l = m^h = 1.5$ (l's firms are shown) and $\nu_1^l = \nu_1^h = 1.2$. The two countries are equal in size. In the middle, the values are identical except that a tariff is used and and l is much smaller than h ($L^l = 170$ and $L^h = 400$). On the right, all of the parameters are again equal except $\tau_1^l = 1.15$ and $\tau_1^h = 1.8$. This highly unequal liberalization generates no winners in l.

firms, the benefits of the latter outweigh the former and they actually gain from an increase in trade barriers in their export market. At the same time some of the least productive exporters will be forced to drop out of the export market, while some less productive exporters will continue exporting but earn reduced profits.[16]

Are there circumstances in which highly productive firms can gain from an increase in tariffs in their export markets? No, and to see the difference between the cases, consider a highly productive firm which has a very low marginal cost. An increase in the variable cost-of-trade has relatively little negative affect on this producer. It only slightly increases their marginal costs per unit exported because more productive firms are assumed to be more adept at negotiating trade barriers. Other less productive producers are harmed significantly more, however, leading to sharply reduced competition in the export market. In the case of a tariff, the most productive firms still charge reasonably high prices in order to maximize their profits, so an increase in the *ad valorem* tariff has a substantial affect. The crucial difference is therefore that while costs of production and trade are one, potentially very small part of the pricing decision, tariffs bluntly reduce the bottom line of any firm by pushing prices and sales down.

This section has focused on attitudes towards trade liberalization at the firm level, describing how the preferences are likely to vary with firm productivity. The an-

[16] Appendix A6 contains a proof of all claims in this section. This result is reminiscent of Abel-Koch (2010) which demonstrates that the most efficient producers may favor a non-zero level of government-imposed costs of production, applying to all firms domestic and foreign. The logic in both results is that such barriers harm the least productive firms more than proportionally.

swers depend strongly on whether the economy is autarkic or open to trade, on the trade instrument which is under discussion, and on the characteristics of the productivity distribution. The section also developed some propositions about the circumstances under which no firms will support trade liberalization. The next section follows up on these claims, examining how the proportion of firms in favor of and opposed to trade change with the characteristics of the trade liberalization, of the country, and of the product.

Overall Industry Orientation

This section uses the results developed so far on firm preferences to explain why some industries are mostly united on questions of trade while others are deeply divided. The previous section concluded that intra-industry differences over trade are commonplace but of course the relative weight of the supporting and opposing camps will differ considerably depending on the contours of the trade agreement and the relative competitiveness of the two countries. In this section, I pursue the implications of this fact. Comparative statics are derived which show how the proportion of firms supporting a given trade liberalization varies with the terms of the trade deal, country size, and Ricardian comparative advantage. It is also shown that product differentiation – the crucial concept for understanding intra-industry trade – is closely linked to the extent of intra-industry disagreement over trade.

In order to simplify the analysis that follows, I will focus only on the case of moving from autarky to trade, while still considering reductions in both tariffs and non-tariff barriers. Examination of numerical examples suggests that most of the results which follow are similar in the case of moving from restricted to more liberal trade, but the notation is unwieldy and the derivations less tractable. Let's define two measures of the proportion of firms supporting the move from autarky to trade liberalization:

Definition 3 The proportion of active firms in autarky which support a given trade liberalization is equal to

$$\frac{G^l(c^l_{pt})}{G^l(c^l_A)} \equiv p^l_{PT}.$$

Similarly, the proportion of profits located in firms which support a given trade liberalization is equal to

$$\frac{G^l(c^l_{pt})N^l_E\left(\int_0^{c^l_{PT}} \pi^l(c)\mathrm{d}G^l(c)\left(\frac{m^l}{c^l_{PT}}\right)^k\right)}{G^l(c^l_A)N^l_E\left(\int_0^{c^l_A} \pi^l(c)\mathrm{d}G^l(c)\left(\frac{m^l}{c^l_A}\right)^k\right)} = \frac{1}{f_E}\int_0^{c^l_{PT}} \pi^l(c)\mathrm{d}G^l(c) \equiv p^{\pi^l}_{PT}.$$

The first two results below summarize all of the key comparative statics relating the trade agreement and Ricardian comparative advantage factors to the percentage of firms (and percentage of profits) supporting the trade liberalization. Some of the comparative statics are derived analytically; others require conditions which are then examined across a set of parameter values to provide some sense of their generality.

Comparative Static 1 The proportion of firms, and firms weighted by profits, who support trade liberalization are:

1. Increasing in domestic tariff and non-tariffs barriers.
2. Decreasing in foreign tariffs.
3. Decreasing in foreign non-tariff barriers as long as the marginal supporter of the trade liberalization would not benefit from higher NTBs in their export market.

These results are proven in Appendices B2 and B3. Recall that the most productive firms always benefit from higher non-tariff barriers in their export market, so the condition in part three cannot be assumed to hold. Due to the complex form of the pro-trade cutoff, it cannot be evaluated analytically but it did hold across every simulated economy.

These results demonstrate that the overall level of opposition to trade agreements depends on the agreed reductions. Agreements which reduce home tariffs less, and foreign tariffs more, find greater support from the differentiated product industry. Again, this highlights that attitudes are circumstantial. A supporter of one trade deal can be a strong opponent of another if the terms are less favorable. Turning to the differences in the productivity distributions between the countries, the results are similarly straightforward.

> **Comparative Static 2** The proportion of firms, and firms weighted by profits, who support trade liberalization are decreasing in foreign average productivity and increasing in foreign costs of entry.
>
> The proportion of firms who support trade liberalization is increasing in domestic average productivity and decreasing in domestic costs of entry, as long as the elasticity of the pro-trade cutoff with respect to the domestic autarky cutoff is less than one.

The condition at the end may seem a little opaque, but it has a straightforward intuitive interpretation. First, recall that we argued that the domestic autarky cutoff is a reasonable proxy for comparative advantage in the differentiated product. This condition then requires that if the comparative advantage of the home country deteriorates by a certain percentage, then the pro-trade cutoff should not *increase* or at least not increase by a greater percentage. Checking the numerical simulations, this condition held across every simulated economy.[17]

Interpreting this result is straightforward. As a country's firms in the differentiated sector become more productive on average, they become relatively better at producing the differentiated product compared to the homogeneous good. Differences in the productivity distributions are therefore a source of Ricardian comparative advantage.[18] This technological source of comparative advantage feeds predictably into the overall level of support for opening to trade. The logic behind the entry cost result is similar. Countries which facilitate the entry of more firms, by lowering the costs of starting a business or by supporting research, for example, have more varieties and are more competitive. This leads to greater support for trade liberalization.

Country Size and Support for Trade

What is the impact of country size on support or opposition to trade? To address this question it helps to decompose the effects of country size into two effects.

> **Comparative Static 3** The impact of changes in country size on producers can be decomposed into two effects:
>
> 1. A *market size effect*: whereby firms earn greater profits in larger markets.
> 2. A *firm entry effect*: whereby larger countries have greater entry, and are more competitive, all other things being equal.

[17] Note also that every simulation across the grid indicated that $\partial p_{PT}^{\pi^l}/\partial m^l$ and $\partial p_{PT}^{\pi^l}/\partial f_E^l$ were negative, but there is no straightforward sufficient condition to include in the comparative static.

[18] Note that $\frac{\partial c_A^l}{\partial m^l} > 0$, indicating that a country with less productive firms are less competitive and therefore their average price in autarky is higher. This reduces their comparative advantage, or exacerbates their comparative disadvantage, in the differentiated product.

For a more formal explication of this argument, see Appendix A7. To see these effects in action, consider an increase in the export market's size for a firm in l. One obvious impact of an increase in h's size is that there are more consumers for l's products in the export market. Absent any other changes, this will increase the profits of l's exporting firms. But an increase in the size of h also increases entry by firms in that country, making their industry both larger and more efficient. Put another way, comparative advantage in the differentiated product is increasing in home country size.[19] This is an example of the 'home market effect' (Krugman, 1980; Davis and Weinstein, 1999). The exact balance of these two forces is not clear analytically.

A similar story can be told about home country size. The first effect of increasing home country size is to make firms prefer a more closed economy. If they have a larger market, then why would they want to share it with foreign competitors? But the other effect of a larger market size is that it makes firms more competitive. The environment in autarky will be very competitive if the country is large, so more firms will be incentivized to break out into new markets where they are now relatively more efficient.

In both cases, these effects work at cross purposes with one another. There are advantages and disadvantages associated with any change in market size, at home or abroad. Which effects will dominate? The following numerical simulations,

[19] In autarky, the average price of the extant varieties in l is $\bar{p}^l = \frac{2k+1}{2k+2} c^l_A$, and$l$ has a comparative advantage in the differentiated product if $c^l_A < c^h_A$. Because $\frac{\partial c^l_A}{\partial L^l} < 0$ the extent of l's comparative advantage in the differentiated product is increasing in L^l (or alternatively, h's comparative advantage in the differentiated product is diminishing in L^l).

which examine the question across a large set of parameter values as described in Appendix B, gives some indication.

Numerical Simulation 1 Across the set of simulated economies, the proportion of firms, and firms weighted by profits, supporting trade liberalization are generally increasing in own country size and decreasing in foreign country size. The exact proportion of cases consistent with these patterns are given in the table below.

	$\partial p^l_{PT}/\partial L^l > 0$	$\partial p^{\pi^l}_{PT}/\partial L^l > 0$	$\partial p^l_{PT}/\partial L^h < 0$	$\partial p^{\pi^l}_{PT}/\partial L^h < 0$
Tariff Case	.96	.99	.96	.96
NTB Case	.95	.99	.96	.96

Although the pattern is not absolute, the vast majority of simulations suggest that the impact of country size on competitiveness is stronger than the market size effect. Firms may prefer to export to a larger market, but larger markets have more competitive firms and the latter effect generally outweighs the former. Similarly, as own country size increases, firms may benefit more from keeping their home market closed but operating in a larger market leads to a more competitive environment. The firms which remain will be fitter and eager to compete abroad.

Product Differentiation and Industry Support

Product differentiation plays a central role in generating intra-industry trade, so the question naturally arises of how variation in product differentiation across industries affects the scope of support or opposition to trade liberalization. This section again relies on simulation to show that product differentiation interacts with the skewness of the productivity distribution to generate changes in support for trade.

Up to this point, we have assumed that the two countries had equal skewness parameters ($k^l = k^h = k$) in the distribution of marginal costs ($G^l = \left(\frac{c}{m^l}\right)^k$). Under this assumption, the overall percentage of firms supporting trade liberalization is unaffected by changes in product differentiation.[20] To see why, consider an increase in consumer love of variety. This will increase the number of firms which are able to produce domestically, because consumers will purchase more high-priced varieties. For similar reasons, it will also increase the number of firms that can export abroad, and the number of firms which benefit from trade liberalization. When the skewnesses are equal across countries, all of these changes occur proportionally leaving the overall percentage of firms which support trade liberalization unchanged.

If we relax the assumption of equal skewnesses then the proportionality of cutoffs as love of variety changes is broken, and the extent of love of variety starts to play an important role in determining the shape of opposition. First note that a lower k implies a cost distribution more skewed towards low cost draws. Therefore, if $k^l < k^h$ and $m^l = m^h$, l's firms will be more productive on average. There are obviously a number of forces at play when love of variety changes, but intuitively we might expect that if $k^l < k^h$, reductions in love of variety would be more than proportionally harmful for firms in h because the viable extent of firms gets pushed

[20] This is proven, but only for the case of moving to long-run equilibria, in Appendix B4. In the short-run, this property does not hold and the proportion of firms supporting trade liberalization can increase or decrease with γ. Numerical examples suggests that the size of this effect is modest and is swamped by the changes in comparative advantage when $k^l \neq k^h$ so I focus only on the long-run here.

into the lower tails of the productivity distributions where firms in h become relatively less populous compared to firms in l. This intuition forms Comparative Static 4.

> **Comparative Static 4** If $k^l < k^h$, the percentage of extant firms in autarky who will export post-liberalization is increasing in consumer love-of-variety in l and decreasing in consumer love-of-variety in h. In contrast, the percentage of firms who serve the domestic market only is decreasing in γ in l and increasing in γ in h.

This results is proven in Appendix B5. In words, this result shows how increases in consumer love-of-variety disproportionately benefit the exporters in the higher-skewed cost country. To understand this, note that increases in love-of-variety increase the number of entrants in both countries as well as the number of domestic-only and exporting firms post-liberalization. The differences between the countries occurs in the size of these increases. For l's firms, an increase in love-of-variety leads to only a moderate reduction in domestic competitiveness because l is getting into the fat part of its distribution. This also keeps h's firms out, limiting their benefits from increases in exports. h is operating in a relatively thinner part of its productivity distribution so increases in love-of-variety lead to significant reductions in the competitiveness in h as consumers struggle to secure more variety. This opens up significant export opportunities for l's firms.

The question here for pinning down the comparative static is which of these effects is bigger. For l's firms, increasing love-of-variety leads to much greater entry and only a modest easing of competition at home, so the proportion of firms which drop out of the domestic market post-liberalization is growing. However, for those that remain there are big new opportunities in their export market. Numerical Simulation 2 shows that the latter effect is always bigger across the range of simulated economies examined in Appendix B5.

> **Numerical Simulation 2** Across the set of simulated economies, if $k^l < k^h$, then the proportion of firms which support trade liberalization in l is decreasing in consumer love of variety; and, the proportion of firms which support trade liberalization in h is increasing in love of variety.

Note that this only applies to transitions to long-run equilibria. The results with short-run equilibria are similar but not always consistent with this pattern.

Expressed in words, Numerical Simulation 2 suggests that the skewness of the productivity distribution is the decisive source of firm attitudes toward trade, and trumps all other sources of relative competitiveness, as love of variety diminishes. When love of variety is high, country size and the support of the productivity distribution express themselves equally with the skewness parameter. When love of variety is low, the skewness of the productivity distribution is the dominant influence on the attitude of the industry towards trade.

Through what channels do changes in product differentiation affect the level of support for trade among firms? A change in product differentiation alters the comparative advantages of the trade partners in the differentiated product. For example, as product differentiation decreases, the comparative advantage of the country with the lower skewness parameter improves. To see this, recall that we argued before that the average price in autarky (denoted by $\bar{p}_A$) is a good proxy for competitiveness in the differentiated product. Using the autarky solutions for the cutoffs, the ratio of the average prices in autarky has the following proportionality:

$$\frac{\bar{p}^l_A}{\bar{p}^h_A} \propto \gamma^{\left(\frac{1}{k^l+2}-\frac{1}{k^h+2}\right)}.$$

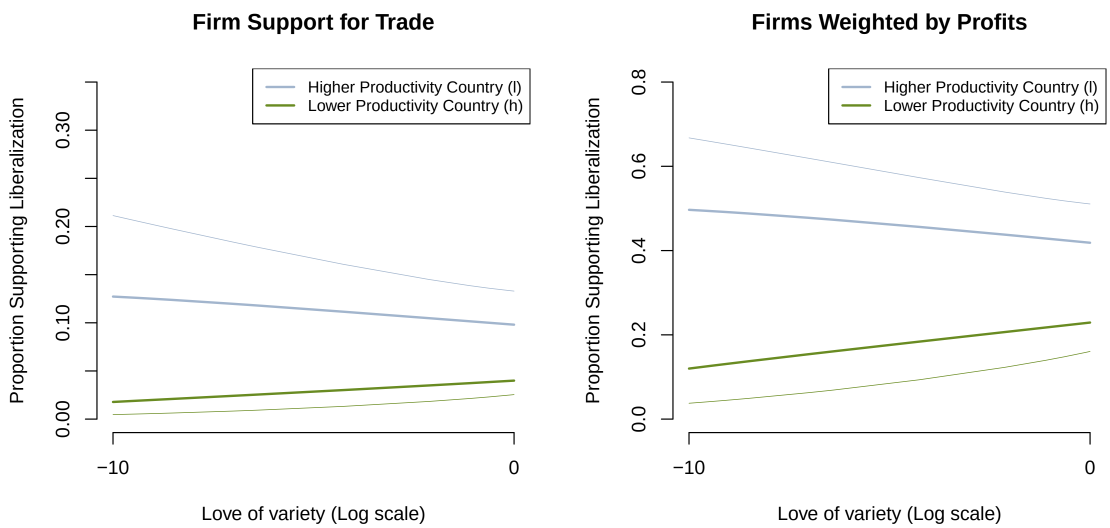

Figure 2.3: This figure provides one set of numerical simulations to illustrate Numerical Simulation 2. The proportion of both firms and profits which support an equal bilateral trade liberalization are decreasing with love of variety in the country with a more productive distribution of firms. They are increasing in the country with a less productive firms, who become more capable of exporting as consumers value product diversity more greatly. The darker lines represent a simulation from a long-term equilibrium and the lighter lines from a short-term equilibrium.

If $k^l < k^h$, then $\frac{\bar{p}_A^l}{\bar{p}_A^h}$ gets larger as γ decreases, meaning that a decrease in γ creates a relatively more competitive environment in l in autarky

We can now consider a set of cases which illustrate the types of dynamics to which Numerical Simulation 2 gives rise. Let's assume that l is unambiguously superior in the production of the differentiated good i.e. $k^l < k^h$, $m^l \leq m^h$ and $L^l \geq L^h$, and the proposed trade liberalization entails equal tariff rates. When love of variety is relatively low, the differentiated product industry in l will be strongly in favor of trade liberalization. This is because free trade permits its firms to access the market in h, knowing they will face only minimal competition from the generally less productive firms in h. This is of course also the point at which l's comparative advantage is greatest. For similar reasons, the firms in h will strongly resist trade liberalization knowing it entails significantly tougher competition in their home market with few opportunities for export abroad.

As love of variety increases, the differentiated sectors in each country will become 'more divided' in the sense that the relative unanimity on whether trade is good or bad breaks down. In h, a growing number of firms will be able to export abroad as l's comparative advantage is eroded. l's firms now face intensified competition from abroad, and increased love of variety also means more relatively unproductive firms – who are likely non-exporters – will survive in autarky and then oppose trade liberalization. There are obviously a complex set of forces at play here, but overall, a smaller proportion of l's firms benefit from trade liberalization in this market than would if love of variety were lower. This class of examples is illustrated in Figure 2.3.

When are industries divided over trade?

Jointly, these comparative statics suggest the circumstances under which intra-industry divisions over trade will be significant, and when they will be muted. Trade agreements which make substantial concessions in exchange for only limited improvements in access abroad will be broadly opposed. Trade liberalizations with much more competitive countries will also face widespread resistance. Conversely, relatively equal trade liberalizations between countries which are equally competitive in the production of the differentiated good are likely to witness substantial intra-industry disagreements over trade. Put another way, intra-industry trade between countries with similar endowments and technology doesn't eliminate competition over trade policy, it simply moves that competition from *between* industries to *within* industries.

A similar story can be told about country size, although, as noted above, the impact of changes in country size are ambiguous in theory. Still, the overwhelming majority of numerical simulations suggested that the level of support for a given trade liberalization is increasing in own country size and decreasing in export market size. This suggests that trade liberalization with significantly larger countries will face stiff resistance from producers, whereas liberalizations with much smaller countries will usually feature a strong level of support. Intra-industry divisions are predicted when countries are similar in size and competitiveness.

Finally, product differentiation plays an important role in determining the level of intra-industry divisions. It was argued that, under a reasonable set of conditions, comparative advantage industries become more opposed to trade as differentiation increases. Comparative disadvantage industries feature more support for trade. This suggests that industries producing relatively differentiated products are 'more divided' over trade. Put another way, industries with substantial intra-industry trade are likely to be the most divided over trade liberalization. The next section makes use of these comparative statics to explore two perennial questions in the study of trade politics.

Applications of the Comparative Statics

The comparative statics described above explain when industries will be united or divided over trade. This section applies these ideas to two long-running debates in trade politics: the popularity of preferential trade agreements; and, the apparent ease of trade liberalization in manufactured goods among the most developed countries. In order to make use of these comparative statics, it is necessary to first sketch out a model of trade politics.

Rather than setting out a complete political economy, which I pursue in Chapter 4, I instead simply assume that governments are cross-pressured when it comes to setting trade policies and making trade agreements, but that *policymakers are especially sensitive to high levels of opposition from producers*. Pressure from multilateral liberalization comes from consumers and firms capable of benefitting from increased exports; opposition to free trade comes from less productive firms and some subset of new and extant exporters. As shown above, trade deals which make too many concessions or which make equal concessions with more competitive trade partners – especially in industries producing homogeneous products – will provoke overwhelming opposition from producers.

This perspective – that the proportion of firms in a given industry which support or oppose a given trade liberalization matters – seems sensible on its face, but it is at odds with the approach in much of the trade literature which focuses on broad movements in aggregates with a government trading off between consumer and producer utility. For example, Chapter 4 shows that larger and more efficient industries generally secure *more* protection than smaller, inefficient ones. This is because they have more to gain in absolute terms from protection, so governments take greater account of their interests relative to consumers. The model defined here would suggest that smaller and more inefficient sectors should secure more protection, because they will be united in opposition to any substantial decrease in the trade barriers which preserve their profits, even if the overall levels of profit at stake are insubstantial.

Country size and regional free trade agreements

The comparative statics in Numerical Simulation 1 showed that with free entry, the proportion of firms supporting a given trade liberalization is usually increasing in own country size and decreasing in trade partner size. This was because country size is a source of comparative advantage in the production of the differentiated goods. Larger countries have lower domestic productivity cutoffs, lower average prices in autarky, and more varieties of the differentiated product. They are therefore a greater source of competition for the home industry when trade liberalization is contemplated.

This result suggests a new perspective on a long-standing puzzle in the literature on trade policy and politics: why do countries form regional or bilateral trading blocs rather than pursue the broadest possible multilateral reductions in trade barriers? The starting point of the literature on regionalism and preferential trading agreements is the observation that, across a wide variety of trade models, free trade is welfare maximizing for both consumers and GDP (Bhagwati, 1999; Sager, 1997). In general, the gains from trade will be smaller among smaller trading blocs, especially if the countries are similar in their endowments and product specialities. At the same time, regional trade agreements still have distributional implications and some may lose from reductions in trade barriers. Any explanation of regional trade agreements rooted in domestic interests must therefore explain why producers (or owners of the scarce factor of production) oppose global or broad multilateral trade liberalization but favor regional or bilateral liberalizations (Mansfield and Milner, 1999).[21]

Preferential trade agreements within the WTO system, which are often regional in nature, entail *smaller numbers* of states, which may have *similar factor endowments*, agreeing on *greater reductions* in trade barriers than those extended to all other members under the usual principle of 'most-favored nation' treatment. The focus on country size and levels of opposition can help explain each of these features.

First, trade agreements among smaller groups of states will, all else equal, feature less resistance from producers. Consider the simple case of a complete liberalization of the economy and the choice of doing so with a small group of neighbors or with a much larger bloc of states. Further assume that all countries share iden-

[21] Eichengreen and Frankel (1995) and Mansfield and Milner (1999) provide extensive reviews of the political and economic arguments for regionalism. In political science, Mansfield and Reinhardt (2003) argue that preferential trade agreements enhance bargaining power in multilateral negotiations, for example, by ensuring access to important export markets or imported resources whether or not multilateral negotiations succeed, or by joining states as negotiating blocs. Milner (1997) and Chase (2003) focus on economic interests at the domestic level, arguing that bilateral or regional trade agreements may allow relatively uncompetitive industries, especially in smaller countries, to exploit economies of scale in production at the regional level, while avoiding the most intense competition at the global level. The explanation here differs in emphasizing country and trade bloc size as a source of comparative advantage, the importance of monopolistic competition rather than monopoly, and intra-industry trade. The latter two explain why two countries producing the same good may both have firms supporting trade liberalization.

tical technology and no country has any advantage in labor costs. The free trade agreement with the larger group of states will nonetheless face considerably more opposition from producers than the agreement with the smaller group of states. This is despite the fact that producers in the larger group have no *a priori* advantage in productivity or factor costs.

Second, rates of trade protection will be lower for preferential trading agreements than for broader multilateral agreements if governments seek to avoid broad opposition from producers. When a country enters into a free trade agreement with a similarly sized and competitive trade partner, both will feature only moderate opposition to even total liberalization. In contrast, a complete liberalization of trade with a much larger group of countries will generate overwhelming opposition in the smaller country. The only way to compensate for this is by limiting concessions made by the smaller country. Within the GATT/WTO system, these types of differences were of course the entire reason for preferential trade agreements in the first place, but the focus on country size explains why such agreements generally secure greater reductions in trade barriers and are a popular alternative to broader agreements.

Third, intra-industry trade combined with firm heterogeneity helps explain why there is an active constituency for regional trade agreements among both consumers and producers, even in countries with similar endowments. It has already been argued that in homogeneous product industries, firms are united in support or opposition to freer trade. If one country has a significant comparative disadvantage in the production of a homogeneous good, then trade liberalization will provoke sharp and united resistance. If, however, the two countries are equally competitive there will be little resistance from producers but no real gains from trade for consumers or producers, either. There is no reason to trade with another country which produces a similar set of homogeneous goods sold at similar prices.

Industries which produce differentiated products, on the other hand, combine significant gains for consumers from liberalization with a base of support among producers. This is even true if the countries produce similar goods in similar proportions. On the producer side, the most efficient firms in *both* countries form a core constituency for freer trade, especially if the two countries have similar factor endowments and inter-industry allocations of production occurring because of liberalization will be limited. Consumers also gain from greater trade, even if changes in prices are relatively muted because the countries specialize in similar products, due to increases in product variety.

This reasoning can also be applied to bilateral trade agreements, which often feature huge size asymmetries between countries. The theory presented here predicts that among these agreements, the concessions made by the larger country will be greater in order to compensate the firms in the smaller country with the greatest possible access to foreign markets. Unequal reductions in tariff or trade barriers serve to equalize levels of support among producers between countries with differences in competitiveness in the production of the differentiated good.[22]

[22] GATT Article XXIV requires that preferential trade agreements generally be complete free trade agreements. The reality has generally been asymmetric reductions in tariffs and trade barriers depending on size and level of development, as well as comparative advantage (Grossman and Helpman, 1995*a*; Wonnacott and Lutz, 1989).

One final point: when bilateral FTAs and other free trade agreements are signed between large and small countries, much is often made of the significant opportunities for expansion for firms located in the smaller country. The model presented here suggests that not all market access is the same, however. In industries without substantial intra-industry trade, cost advantages for an industry in the smaller country would generally imply gains from trade, because greater trade raises the price of their product. Larger foreign markets also mean greater increases in the price of goods in which they hold a comparative advantage. In industries with substantial product differentiation, however, smaller industries can be swamped by a flood of foreign varieties from a much larger competitor – even if they have cost advantages in factors of production or superior technology – due to size-induced productivity improvements in the larger country. Understanding the implications of market size for potential exporters therefore requires understanding the types of trade patterns that will result from liberalization.

The challenges of liberalization with homogeneous goods

The trade politics literature has emphasized the relative ease of trade liberalization in markets for differentiated products among the wealthiest nations, when compared to the more homogeneous products traded between the developing and developed world (Hufbauer and Chilas, 1974; Marvel and Ray, 1987). For example, the pre-1994 GATT rounds featured enormous, if not continuous, reductions in tariffs and non-tariff barriers on manufactures among the OECD countries, with the sole exception of textiles and apparel (Irwin, 1995). In contrast, agricultural goods and other commodities have remained far more protected (Kee, Nicita and Olarreaga, 2009). The role of product differentiation is seemingly crucial in explaining this long-term trend for two reasons. First, manufactured goods tend to feature greater differentiation then more-protected tradeables sectors like minerals and agriculture. Second, product differentiation provides a motivation for trade liberalization among similarly capital-rich countries.

Krugman (1981) and Alt et al. (1996) provide theoretical underpinnings for this pattern. In an economy with multiple endowments, changes in real factor incomes are relatively muted when two similarly-endowed countries liberalize and mutually export differentiated products. Product differentiation also offers additional gains from trade for consumers, including expanded variety and improvements in firm productivity, which may help to overcome losses in nominal earnings for owners of relatively scarce factors (Bernard, Redding and Schott, 2008). Opportunities for export for both sides also are likely to mute inter-industry reallocations of production, and in a model without firm heterogeneity raise the possibility that all producers might benefit from trade liberalization or at least not be harmed too greatly.

This paper has taken a different tack by emphasizing firms' preferences and including firm heterogeneity in productivity, but points toward the same conclusion: trade liberalization should be easier and less antagonistic in industries with significant product differentiation. This contention arises naturally as an intrinsic feature of the model, as described in Numerical Simulation 2. It also is available extrinsically, when this model is compared to the standard approaches to trade with a homogeneous product.

First, consider the comparison of the model presented here and the standard trade model, which features a single good in a perfectly competitive market, and no intra-industry trade. As demonstrated in Propositions 1-3, the combination of product differentiation and firm heterogeneity leads to intra-industry divisions over trade across a wide variety of circumstances. For an industry producing a non-homogeneous product at a comparative disadvantage, opposition to trade is both lower in the aggregate then it would be if the product were completely homogeneous and internally contradicted by productive exporters who have the possibility of gaining from trade. Policymakers attempting to read the industry's views will receive mixed signals from firms depending on their productivity and ability to export. And to the extent that larger firms are better able to communicate their interests, policymakers will receive a biased impression of the extent of support for trade (Sadrieh and Annavarjula, 2005; Drope and Hansen, 2006). No such differences of opinion will exist in industries producing homogeneous products, and the largest firms will have the same preferences as their smaller domestic competitors.

Effective organization for trade protection is also likely to be more difficult in industries with product differentiation and firm heterogeneity. Differences of opinion on trade policy are ubiquitous in this model, obviating any rationale for working together among competing groups in the industry even as the collective action problem still applies. Note also that attitudes toward trade are fluid and situational, depending on a firm productivity itself (which might change over time), whether the liberalization is a move from autarky or partial trade, and on the specific terms of the trade deal. In these circumstances, firms may not have solidly developed attitudes towards trade liberalization and so may be unwilling to invest heavily in political organization when clashes with their fellow firms are in the offing. This insight provides an alternative gloss on Bombardini and Trebbi (2012)'s finding that firms in industries producing differentiated products are less likely to lobby as a trade association than those producing homogeneous products. Rather than a consequence of firms seeking variety-specific protection, it may be that internal divisions and unclear preferences over trade, as a general proposition, lead firms to pursue lawmakers individually as the circumstances of the particular trade deal warrant.

Comparing industries with different levels of product differentiation interior to the model suggests a similar story. Numerical Simulation 2 suggested that the impact of product differentiation on support for trade depends crucially on the skewness of the productivity distribution. The implications of this are more clear if one assumes that these differences in skewness, which absent other asymmetries make the country more skewed towards lower costs draws more competitive, are the only source of comparative advantage. More generally, one can assume that the other sources of comparative advantage are consonant with the difference in skewness. Either way, it then follows that the industry in the country at a comparative disadvantage in the differentiated product becomes *less* opposed to trade as product differentiation increases. At the same time, more firms in the industry oppose trade liberalization in the county at a comparative advantage in the differentiated product.

Increasing love of variety thus erodes the level of opposition to trade liberalization among firms in the country at a comparative disadvantage, who usually are the greatest stumbling block to freer trade. If governments seek to avoid overwhelming opposition among firms to trade liberalization, then greater love of variety makes trade liberalization easier to accomplish. Moreover, in a hypothetical move from relatively limited or autarkic levels of trade to greater liberalization, these new proponents of trade are likely to be among the larger and more productive firms, who are plausibly more influential in the determination of trade policy. Of course, the flip side of this is that as product differentiation increases the country at a comparative advantage will now have more opponents to trade liberalization. Still, if the proposed trade liberalization is reasonably equal, there will be fewer opponents than in the country at a comparative disadvantage so opposition will remain relatively weak and concentrated among the smallest firms.

The organizational considerations described above also point in the same direction. When goods are relatively homogeneous in this model, industry attitudes toward trade are, too. Fewer divisions in attitudes don't overcome the collective action problem, but they at least ensure shared objectives and more widespread gains assuming that the industry does overcome impediments to organization. In addition, the uncertainties associated with interests over trade, in particular, how interests will depend on the exact terms of the trade deal, are minimized. All of these obstacles to organization are heightened as the good becomes more differentiated, and may offer a plausible account for why trade liberalization has been easier with differentiated products than in industries producing homogeneous products.

Finally, this focus on firms and product differentiation may help explain the broad, global movement towards steadily decreasing trade barriers since the creation of the GATT in 1994. Intra-industry trade has increased steadily over time, which is indicative that product differentiation has as well (Brülhart, 2009). Because these two concepts are so closely linked to the intra-industry divisions over trade in this model, and so many new tradeable goods are highly differentiated consumer products, it may be that a gradual increase in product differentiation is implicated in the steady erosion of trade barriers and the globalization of the world economy.

Conclusion

To conclude, I expand the discussion of the contribution of the paper to the literature on international trade in political science. Four themes are emphasized. First, incorporating firm heterogeneity and intra-industry trade into models of trade politics is important in its own right, because political economic models of trade politics should match patterns of trade (Rodrik, 1995). Second, incorporating these features into our understanding of trade politics leads to significant and non-obvious conclusions about who supports and opposes trade. Third, understanding trade preferences at the firm level helps us understand patterns of organization and opposition at the industry- or economy-wide level. Fourth, a firm-level approach helps explain several puzzling features of trade politics, including the existence of intra-industry divisions over trade and the broad movement towards freer trade in the post-war era.

Matching theories of trade politics to trade patterns

The basic contribution of this paper is to develop a theory of preferences over trade which incorporates two recent developments in the economics of international trade. Understanding the economic motivations behind preferences over trade policy starts with understanding how trade impacts the incomes of factor owners. The most commonly used models of trade politics are based on an incomplete picture of trade patterns, however. Two developments in the understanding of international trade are absent from the traditional approaches. First, the majority of industries feature *intra-industry trade*, that is, countries are both importers and exporters of varieties of essentially the same good. Second, only a minority of firms generally export, even in industries which are highly competitive in export markets.

The implications of incorporating these features into our models of trade politics are substantial. Most fundamentally, trade liberalization has significant redistributive effects within industries, shrinking or closing down certain firms even as others expand. Understanding the impact of an increase in trade therefore requires careful consideration not just of an industry's place in the world but of each constituent firm's place in their industry. Identifying winners and losers from trade is not as simple as dividing exporters from non-exporters, however. An original contribution of this work is to show that when trade liberalization occurs in already partially open markets, the largest extant exporters do not make the greatest gains in profits. In fact, they may lose profits from increased access to their export markets because of greater competition from compatriot firms.

It is argued that intra-industry reallocations of production and the resultant changes in profits determine firms' preferences over trade liberalization. This paper therefore suggests an alternative to the class- and industry-based approaches to trade politics which have prevailed in political economy. Just as the debate between these theories focused on the specificity of factors of production, this model is based on the assumption that capital is firm specific, essentially a sunk cost. This is a strong assumption, but one which may be quite suitable for the short-term and has strong empirical grounding in the literature on firm entry in industrial organization.

Variation in attitudes toward trade at the firm level also complicates the organizational dimension of trade politics. On one hand, industries are internally divided over trade between those who can and cannot benefit from greater export opportunities. Under these circumstances, pre-existing organizations may be fractured and competing organizations may develop. On the other hand, one of the major themes of this paper is that attitudes toward trade are highly contingent and depend on existing trade patterns, industry features at home and abroad, and the terms of the trade liberalization. The exact borders between supporters and opponents of trade liberalization are likely to change over time and from agreement to agreement, making it harder to form durable, coherent organizations to influence policy.

An additional organizational implication of this research is that inter-industry coalitions organizing on trade issues are likely to divide industries. In a Heckscher-Ohlin economy, coalitions on trade cross all industries, uniting factor owners who share a common interest in trade liberalization. In a Ricardo-Viner economy, inter-industry coalitions link up industries with similar comparative advantages, and divide factors. These coalitions are based only on a shared orientation towards free trade, rather than a shared interest in particular policies, however. In the model proposed here, inter-industry coalitions on trade combine these features. All firms which are capable of profiting from trade liberalization, including productive firms from industries at a comparative disadvantage, may band together to support trade liberalization. Firms which are harmed by trade may also work together to resist trade liberalization. Coalitions are therefore broad, although only based on a common preference for freer trade.

The extent of intra-industry division

The model developed here suggests that industries producing a differentiated product are often divided over trade. However, the balance of power between pro- and anti-trade firms varies considerably depending on the relative competitiveness and size of the trade partners, and the agreed reductions in trade barriers. There are also circumstances, generally requiring some significant disparity in the liberalizing countries' comparative advantages or agreed reductions in trade barriers, when industries will be unanimously opposed to trade liberalization. These comparative statics therefore provide a theory of when industries will be mostly united, or sharply divided, over trade.

Differences in technology play a predictable role: as the average productivity of firms in the differentiated product industry decrease, more of those firms will lose profits in the wake of trade liberalization. Industries which are extremely uncompetitive relative to their trade partners are therefore likely to be mostly opposed to trade liberalization. It is possible that no firms will benefit from trade liberalization if the competing firms abroad are significantly more productive, although some firms will nonetheless continue to produce and even export.

Country size, which here indicates the endowment of labor and number of consumers, also plays a fundamental role because larger countries can support a larger number of firms. With a richer set of available varieties, consumers in larger countries drop the least competitive firms and those that remain when it comes time to compete globally are more productive. Trade liberalization between countries with extreme size differences is therefore likely to provoke relatively unanimous support in the larger country and opposition in the smaller country. Similarly sized economies will generally feature more pronounced divisions within industries over trade. Note also that the greater competitiveness of firms in larger countries generally swamps any benefit to foreign producers of gaining access to larger markets, again emphasizing how intra-industry trade alters the received wisdom on trade politics. In this setting, larger markets are not more desirable export targets because they can export back.

The role of product differentiation is also crucial for understanding the extent of divisions over trade. Consumer love of variety is a fundamental primitive for an industry with significant implications for firm behavior, market structure and trade patterns. Its role in trade politics is not well understood, however. This paper makes headway on this problem, demonstrating that the level of product differentiation strongly impacts the extent of intra-industry division. Under a plausible set of circumstances, which are described in the paper, a clear result emerges. Industries at a comparative disadvantage in the production of a differentiated product become more in favor of trade liberalization as product differentiation increases; industries at a comparative advantage become more opposed to trade liberalization.

Empirical applications

These ideas shed light on several empirical patterns in the politics of trade. Most importantly, the theory predicts that intra-industry divisions over trade are likely to be widespread. These divisions were first systematically documented in Milner (1988*b*) and are a recurring feature of disputes over trade although they have received relatively little attention in the scholarly literature.[23] In apparent contradiction to standard approaches, firms publicly express divergent preferences over trade agreements and trade disputes. Journalistic accounts in trade publications and mass media emphasize splits within industries over pending trade legislation. Separate trade associations representing the same industry contradict one another in USITC testimony and ITA reports, and issue competing press releases.

Of course, a sensible first instinct is that these divisions occur because the industries are truly producing separate products, and intra-industry trade is simply a poorly measured construct concealing trade in entirely different goods. Intra-industry divisions could also be the result of variation in the multinationalization

[23] Hathaway (1998) also describes several instances of intra-industry divisions over trade in segments of the textile and apparel sectors. Schattschneider (1935) discusses divisions within industries extensively, but only in the context of unilateral trade policy determination.

of production, with firms who outsource production supporting trade liberalization in their own industry. I argue in the next chapter that while these arguments are certainly valid in some instances, the ideas presented here provide the best explanation for the origins of intra-industry disputes over trade in a great number of other instances.

The comparative statics described above also shed light on two striking empirical regularities in the study of international trade. The first of these is that there has been a steady reduction in trade barriers over the past 70 years, especially among the wealthiest countries and for manufactured goods (rather than agricultural products, for example).[24] While this is obviously a complex historical process with many explanations, it is suggested that the rise of differentiated products may have played a role because it fractured industry-based coalitions against trade liberalization. A second striking feature of post-war liberalization is the rise of regional and bilateral preferential trading agreements. It was argued here that these agreements provide a way for countries to expand product variety and export opportunities for producers, while avoiding the fiercest competition from large trading blocs.

Further questions for the study of trade

The model presented above suggests several avenues for future research on the politics of trade. First, because the contrast between the standard trade model,

[24] Although, Goldstein and Gulotty (2011) and Kono (2009) suggest that this narrative may be too pat.

which features no product differentiation, and the model presented above is so striking, it seems natural to focus on product differentiation and intra-industry trade as crucial areas for future research. This is all the more true because intra-industry trade accounts for such a large volume of trade flows, and because the extent of product differentiation differs sharply across industries. The result presented in Numerical Simulation 2 only makes a start on this tricky set of questions. There is a need for more theorizing and more empirical analysis to disentangle the key role played by the extent of product differentiation in trade politics.

Second is the question of whether firm-specific protection is available as an alternative to broader industry-wide barriers to trade. If so, increases in product differentiation may have a far less salubrious effect on the health of the international trading regime. Many have suggested that the highly specific categories of tariff schedules or the availability of anti-dumping and countervailing duties as trade remedies, both of which can be initiated by firms, are indicative of firm-specific protection. This may be so, but there is a need for more systematic research on this question.

There is also a need for more careful empirical work, at the industry level, on attitudes towards trade of business owners and their employees. Industries vary considerably in market structure, product characteristics, competitiveness, firm structure, trade protection, international integration, sources of inputs, and much else. While I believe the ideas presented here have some general applicability, every industry's story on trade is a little different. Understanding how these details affect the very broad story told here is an interesting area for further research.

Finally, the literature on firm heterogeneity in international trade is now very rich, and there are many possible new applications for political economy. One major question is how patterns of outsourcing and multinationalization affect attitudes towards trade policy and other economic policies. A major finding in this literature has been that only a very few productive firms are capable of taking advantage of opportunities to outsource, echoing the similar findings on trade which motivated this chapter. Second, how does variation in the impact of trade at the firm level impact the attitudes of workers over trade within the same industry? This chapter suggests some tentative answers to these questions, if workers interests are aligned with their employers. Of course, the conditions under which that will be the case need careful explication. Overall, there is a vast array of opportunities for an improved understanding of the politics of globalization based on the literature on firm heterogeneity.

Appendix A: The Model and Results on Preferences

This appendix has two purposes. First, to reintroduce the model developed in Melitz and Ottaviano (2008), highlighting the features of the model which are most important for understanding firm preferences over trade. Second, to present an amended version of the model which uses an *ad valorem* tariff rather than the variable cost of trade employed in the original paper. This change leads to a few relatively straightforward changes in the model solutions.

As in Melitz (2003), and most of the subsequent literature on firm heterogeneity in export performance, firms engage in monopolistic competition. An endogenously determined set of varieties of a differentiated product are produced. Each variety is indexed by $i \in \Omega$. Each firm monopolizes production of a single variety, producing q_i units. There are L workers/consumers in the economy who each consume $q_i^c = \frac{q_i}{L}$ units of variety i. Varieties of the differentiated good are imperfect substitutes, therefore consumers value diversified consumption. Consumer utility is given by

$$U = q_0^c + \alpha \int_\Omega q_i^c \, \mathrm{d}i - \frac{1}{2}\gamma \int_\Omega (q_i^c)^2 \, \mathrm{d}i - \frac{1}{2}\eta \Big(\int_\Omega q_i^c \, \mathrm{d}i \Big)^2.$$

q_0^c represents a single consumer's consumption of a homogeneous numeraire good, an addition to the model which under certain assumptions holds wages across sectors at unity.[25] α and η alter relative demand for the differentiated product. γ determines consumer love of variety. As $\gamma \to 0$, the varieties become perfect substitutes and consumers care only about total consumption $Q^c \equiv \int_\Omega q_i^c \, \mathrm{d}i$.

[25] These are: the numeraire is produced at constant cost equal to 1 in a competitive market; and, all labor is employed at all times. It is also assumed that $q_0 \geq 0$ in equilibrium.

As originally shown in Ottaviano, Tabuchi and Thisse (2002), consumer inverse demand takes on an appealingly simple form,

$$p_i = \alpha - \gamma q_i^c - \eta Q^c$$

where p_i represents the price paid *by the consumer*, which will differ from the amount earned by exporting firms when there are tariffs. Given L^l total consumers, aggregate demand for variety i is

$$\begin{aligned} q_i &= \frac{L^l}{\gamma}(\alpha - p_i - \eta Q^c) \\ &= \frac{L\alpha}{\eta N + \gamma} - \frac{L}{\gamma} p_i + \frac{\eta N}{\eta N + \gamma} \frac{L}{\gamma} \bar{p} \end{aligned}$$

where N is the measure of varieties consumed, and $\bar{p}$ is their average price.[26] Demand turns negative at a choke price defined by $p_i = \alpha - \eta Q^c = \frac{1}{\eta N + \gamma}(\gamma\alpha + \eta N \bar{p})$, a feature of the demand system which in an open economy with costly trade precludes high price firms from exporting.

Within the differentiated sector, firms are assumed to differ in their constant marginal cost of production, c. All firms simultaneously pay f_E, a fixed cost of entry, in order to learn their cost of production. For the moment, assume c is drawn from a distribution G with support on $[0, m]$. Two countries will be denoted by the superscripts l and h. All assumptions and results will be phrased in terms of l. Countries can vary by number of workers/consumers (L^l), distribution of firm marginal costs (G^l), and trade policies. Two policy instruments are explored: an *ad valorem* tariff, τ^l, and a variable cost-of-trade, which will be referred to as a non-

[26] To see that the two expressions for q_i are equivalent, integrate the expression for inverse aggregate demand over the measure of varieties, solve for Q^c, and substitute into the first expression for q_i.

tariff barrier, ν^l. The variable cost-of-trade is multiplicative of the marginal cost c. Note than an exporter in h earns $p_i^{firm} \equiv p_i^f$ for every unit sold to l's consumers, who pay $p_i \equiv \tau^l p_i^f$ and the government earns $(\tau^l - 1)p_i^f$ in tariff revenue for each unit sold. From here on out the analysis will focus on the tariff case, because the variable cost-of-trade case is presented in Melitz and Ottaviano (2008).

Profits for a firm in l producing for the domestic and export markets are respectively

$$\pi_D(c) = [(\alpha - \frac{\gamma}{L^l} q_D(c) - \eta Q^{cl}) - c] q_D(c)$$

and

$$\pi_X(c) = [\frac{1}{\tau^h}(\alpha - \frac{\gamma}{L^h} q_X(c) - \eta Q^{ch}) - c] q_X(c)$$

Maximization of profits domestically, as long as $q_D(c) \geq 0$, yields the following optimal production for the domestic market: $q_D(c) = \frac{L^l}{2\gamma}(\alpha - \eta Q^{cl} - c)$. Note that if $c > \alpha - \eta Q^{cl}$ then $q_D(c)$ is negative.[27] $\alpha - \eta Q^{cl}$ thus represents a threshold in the support of the productivity distribution which divides firms between those who continue to produce after learning their cost draw, and those who cease to serve the domestic market. We thus define $c_D^l \equiv \alpha - \eta Q^{cl}$ as the *zero-profit domestic productivity cutoff* for firms both operating and selling in l. Upon paying their fixed cost of entry,

[27] The complete Kuhn-Tucker conditions for the domestic sales problem are:

$$[\alpha - \frac{2\gamma}{L} q(c) - \eta Q^c - c] q(c) = 0$$

where

$$[\alpha - \frac{2\gamma}{L} q(c) - \eta Q^c - c] \leq 0 \text{ and } q(c) \geq 0.$$

The conditions for the exporting problem are analagous.

any firm in l for whom $c > c_D^l$ will find no demand for their variety in l and so will desist in selling in l.

Maximization of profits in the export market generates an analagous expression for optimal production for the foreign market: $q_X(c) = \frac{L^l}{2\gamma}(\alpha - \eta Q^{ch} - \tau^h c)$. The firm therefore has no market for its goods abroad if $c > \frac{\alpha - \eta Q^{ch}}{\tau_h}$, and so we define $c_X^l \equiv \frac{\alpha - \eta Q^{ch}}{\tau_h}$ as the *zero-profit export productivity cutoff*. Note that the definition of c_D^h is embedded in c_X^l giving the relationship $c_X^l = \frac{c_D^h}{\tau^h}$.[28]

With these cutoffs defined we can return to the equations for sales (q_i), price (p_i), and profits (π) and fashion some more useful expressions:

$$
\begin{aligned}
p_D^l(c) &= \frac{1}{2}(c_D^l + c) & \qquad p_X^l(c) &= \frac{\tau^h}{2}(c_X^l + c) \\
q_D^l(c) &= \frac{L}{2\gamma}(c_D^l - c) & \qquad q_X^l(c) &= \frac{L^h}{2\gamma}\tau^h(c_X^l - c) \\
\pi_D^l(c) &= \frac{L}{4\gamma}(c_D^l - c)^2 & \qquad \pi_X^l(c) &= \frac{L^h}{4\gamma}\tau^h(c_X^l - c)^2.
\end{aligned}
$$

Note in the export case the divergence between prices paid by consumers (p_X^l) and those earned by firms ($p_X^{fl} = \frac{p_X^l(c)}{\tau^h}$) which determine the amount of profits.[29]

Recall that before production begins, potential producers pay a fixed cost f_E to learn their marginal cost of production, c. Free entry implies that expected profits net of the fixed entry cost are pushed to zero, as long as a non-zero mass of entrants choose to enter the market. Let's define N_E^l as the number of firms entering in l. Of these, $G^l(c_D^l)N_E^l$ produce for the domestic market and $G^l(c_X^l)N_E^l$ export to h. To

[28] Note that the same relationship between the domestic cutoff in l and the exporting cutoff in h holds for the case of a variable cost of trade, i.e. $c_X^l = \frac{c_D^h}{\nu^h}$.

[29] For the case with a variable cost of trade, $p_X^l(c) = p_X^{fl}(c) = \frac{\nu^h}{2}(c_X^l + c)$ and profits are $\frac{L^h}{4\gamma}(\nu^h)^2(c_X^l - c)^2$.

solve for all cutoffs, we assume that $N_E^l > 0$, which then implies:

$$\begin{aligned}
0 &= E[\pi(c)] - f_E \\
0 &= \int_0^{c_D^l} \pi_D^l(c) g^l(c)\,\mathrm{d}c + \int_0^{c_X^l} \pi_X^l(c) g^l(c)\,\mathrm{d}c - f_E \\
0 &= \int_0^{c_D^l} \frac{L^l}{4\gamma}(c_D^l - c)^2 g^l(c)\,\mathrm{d}c + \int_0^{c_X^l} \frac{L^l}{4\gamma}\tau^h (c_X^l - c)^2 g^l(c)\,\mathrm{d}c - f_E
\end{aligned}$$

The equivalent condition holds for h, giving us two equations to pin down all cutoffs. Substituting in the relations $c_X^l = \frac{c_D^h}{\tau^h}$ and $c_X^h = \frac{c_D^l}{\tau^l}$, we can solve for all four cutoffs.

In order to find explicit solutions for all cutoffs, we must now specify a distribution for $G^l(c)$. I follow Melitz and Ottaviano (2008) and assume that costs are distributed Pareto, $G^l(c) = (\frac{c}{m^l})^{k^l}$ for $c \in [0, m^l]$. I further assume that $k^l = k^h = k$ and while m^l and m^h can differ. Using this distribution we can now solve for the domestic productivity cutoffs, and by extension, the exporting cutoffs:

$$c_D^l = \left(\frac{\gamma}{L^l} \frac{\phi^l - \rho^h \phi^h}{1 - \rho^h \rho^l} \right)^{\frac{1}{k+2}}$$

where $\phi^l = 2(k+1)(k+2)(m^l)^k f_E^l$, $\rho^l = (\tau^l)^{-k-1}$, and ϕ^h and ρ^h are defined analagously.[30]

With the cutoff solutions from above, the equation for aggregate demand of variety i is used to solve for the number of firms serving in each economy (N^l and

[30] Note that this solution differs slightly from the case with a variable cost of trade, which is

$$c_D^l = \left(\frac{\gamma}{L^l} \frac{\phi^l - \sigma^h \phi^h}{1 - \sigma^h \sigma^l} \right)^{\frac{1}{k+2}}$$

where $\sigma^l = (\nu^l)^{-k}$.

N^h).[31]. The following identities,

$$N^l = N_E^l G^l(c_D^l) + N_E^h G^h(c_X^h)$$

$$N^h = N_E^h G^h(c_D^h) + N_E^l G^l(c_X^l),$$

determine the number of entrants in each economy (N_E^l and N_E^h) The derivations are given in greater detail in Melitz and Ottaviano (2008), but the end result is that

$$N_E^l = \frac{2(k+1)\gamma}{\eta(1-(\tau^h\tau^l)^{-k})(m^l)^{-k}} \left(\frac{\alpha - c_D^l}{(c_D^l)^{k+1}} - (\tau^l)^{-k} \frac{\alpha - c_D^h}{(c_D^h)^{k+1}} \right).$$

We have now collected a couple of assumptions, which it is useful to summarize because they play an important role in the analysis. The restrictions placed on cutoffs, and the requirement that entry be positive are presented together in Assumption 1.

Assumption 1: All long-run equilibria in l feature:

1. $N_E^l > 0$ (Positive Entry)
2. $c_D^l < m^l$ (Dropout)
3. $q_0^l > 0$ (No specialization)

Parts 2 and 3 of Assumption 1 are mainly technical assumptions to ensure that the model is solved as presented above. However, they both have a substantive

[31] Doing so involves a few steps. First, recall that aggregate demand for each variety in l is given by $q_i = \frac{L^l\alpha}{\eta N^l+\gamma} - \frac{L^l}{\gamma}p_i + \frac{\eta N^l}{\eta N^l+\gamma}\frac{L^l}{\gamma}\bar{p}^l$. Second, $q_i^l = 0$ where $p_i^l = c_D^l$ which allows us to simplify this expression and solve for N^l. Third, $\bar{p}^l$, the average variety price faced by consumers in l, is easily solvable in terms of parameters and cutoffs because the distribution of productivities of the firms in market l is the same for both domestic production and imports. As in Melitz and Ottaviano (2008), this is $\bar{p}^l = \frac{2k+1}{2k+2}c_D^l$. After some simplification, $N^l = \frac{2(k+1)\gamma}{\eta}\frac{\alpha - c_D^l}{c_D^l}$.

interpretation. Part 2 means that at least some firms which enter the market quit without producing anything. Part 3 means that no country ends up specializing in only the differentiated good. This fixes wages across the economy at 1 and greatly simplifies treatment of the labor market.

In contrast, Part 1 is an assumption with considerable implications [See Appendix A1 for formal proofs]. First, positive entry guarantees that $c_X^l < c_D^l$ i.e. that only a subset of those who produce for the domestic market will also export their variety. This reflects a now well-established finding in the literature on firm participation in trade: across a wide variety of industries and countries, only a subset of firms which produce domestically are also exporters. Moreover, very few or no firms export without also producing domestically. Positive entry also implies that $c_D^l > 0$.

Finally, Melitz and Ottaviano (2008) also present a short-run version of the model which features a set of extant firms $\bar{N}_D^l$ serving the domestic market with a productivity distribution truncated by a previous round of exit lying on $[0, \bar{m}^l]$. The short run version of the model has no closed form analytic solutions for the cutoffs. A complete derivation of the implicit solutions for the cutoffs (which in turn determine all other endogenous variables) is provided in Melitz and Ottaviano (2008), but briefly, the zero-profit conditions used to solve for the number of firms serving each market above are re-deployed this time using the fixed number of entrants to determine the new cutoffs. So long as $c_D^l < \bar{m}^l$ and $c_X^l < \bar{m}^l$ then we can use the following to solve for c_D^l in the short term:

$$\frac{\alpha - c_D^l}{(c_D^l)^{k+1}} = \frac{\eta}{2(k+1)\gamma}\left(\frac{\bar{N}_D^l}{(\bar{m}^l)^k} + (\tau^l)^{-k}\frac{\bar{N}_D^h}{(\bar{m}^h)^k}\right)$$

All short-run equilibria used in this chapter will be transitions away from long-run equilibria. For example, in the section on moving from autarky to an open economy, I will asume that $\bar{N}_D^l = N_A^l$ and $\bar{m}^l = c_A^l$. In the section on moving from more to less restricted trade, the starting point will again be a long-term equilibrium with costly trade. This is done to ensure comparability with the long-run results, which feature moves from one long-run equilibria to another, and to start out with a defensible and theoretically grounded distribution of entrants, rather than arbitrary numbers.

Short-run equilbria of this type allow us to dispense with the first two elements of Assumption 1, giving a refined Assumption 2 for short-term equilibria. First, entry will always be positive when $\bar{N}_D^l > 0$. Second, $c_D^l < m^l$ when m^l is the domestic cutoff from a long-run equilibrium. Third, and most usefully, $c_X^l < c_D^l$ for any short-run equilibrium based on an existing long-run equilibrium. As noted above, this ordering of the cutoffs is well-established empirically and simplifies the analysis of the model without any extra assumptions. Proof of these latter two contentions are contained in Appendix A1.

Assumption 2: All short-run equilibria in l feature:

1. $q_0^l > 0$ (No specialization)

A1: Ordering all Cutoffs

This section of the appendix is devoted to establishing two patterns in the cutoffs. First, that in the case of moving from autarky to trade,

$$0 < c_X^l < c_D^l < c_A^l.$$

Second, that in the case of moving from less trade to more trade

$$0 < c^l_{X0} < c^l_{X1} < c^l_{D1} < c^l_{D0}.$$

These orderings are done for transitions from long-run equilibria to both short- and long-run equilibria, to provide some sense of the generality of the results. I make use of Assumptions 1 and 2 throughout, as well as that $\tau^1 < \tau^0$ for both countries. This section (A1) includes results form Melitz and Ottaviano (2008), which if repeated are referenced, as well as new results.

All cutoffs are positive: First, we check for the long-run. Positive entry implies that average expected profits net of fixed costs are zero, so in l, $E[\pi^l] = f_E > 0$. At this point, we only assume that $c^l_D \geq 0$ and $c^l_X \geq 0$ (a negative cutoff is non-sensical). Firm willingness to pay the cost of entry implies that either c^l_D or c^l_X are positive. Let's suppose that c^l_X is positive. This also means that c^h_D is positive which implies that the second term in the expression for N^l_E is negative. This is so because $c^h_D > 0$ implies a positive number of firms serving h ($N^h > 0$) which implies $\alpha - c^h_D > 0$. Positivity of N^l_E then requires that c^l_D be strictly greater than zero. The alternative is that $c^l_D > 0$ but c^l_X (and therefore c^h_D) might be zero. If $c^l_D > 0$, the second term in N^h_E will be negative, so positivity of N^h_E requires that $c^h_D > 0$. Using the fact that τ^l and $\tau^h \geq 1$ and $c^l_X = \frac{c^h_D}{\tau^h}$, this shows that the exporting cutoffs are also positive.

For transitions to the short-run, the domestic productivity cutoff is defined by:

$$\frac{\alpha - c^l_{D1}}{(c^l_{D1})^{k+1}} = \frac{\eta}{2(k+1)\gamma}\left(\frac{N^l_{E0}}{(m^l)^k} + (\tau^l_1)^{-k}\frac{N^h_{E0}}{(m^h)^k}\right).$$

When $\tau^l_1 = \tau^l_0$ then $c^l_{D1} = c^l_{D0} > 0$. Reductions in τ^l_1 reduce c^l_{D1} continuously but it is never pushed below zero, because an arbitrarily large right hand side can be acommodated by a small, but positive, c^l_{D1}. For example, a firm will always produce after any trade liberalization after autarky with any size country. As above, it is also the case that c^l_{X1} must be greater than zero.

$\underline{c^l_X < c^l_D < m^l}$: For the long-run case, positive entry in l implies $c^h_X < c^h_D$. This proof is replicated from Melitz and Ottaviano (2008).

$$\begin{aligned}
0 &< N^l_E \\
0 &< \frac{2(k+1)\gamma}{\eta(1-(\tau^l\tau^h)^{-k})(m^l)^{-k}}\left(\frac{\alpha - c^l_D}{(c^l_D)^{k+1}} - (\tau^l)^{-k}\frac{\alpha - c^h_D}{(c^h_D)^{k+1}}\right) \\
0 &< \frac{\alpha - c^l_D}{(c^l_D)^{k+1}} - (\tau^l)^{-k}\frac{\alpha - c^h_D}{(c^h_D)^{k+1}} \\
0 &< \frac{\frac{\alpha}{\tau^l} - c^h_X}{(c^h_X)^{k+1}} - \frac{\alpha - c^h_D}{(c^h_D)^{k+1}}
\end{aligned}$$

This inequality can only hold if c^h_D is strictly greater than c^h_X. Note that the proof is identical for the case of a variable cost-of-trade ν^l.

For the long run case, it must be assumed that $c^l_D < m^l$ (see Assumption 1). We will shortly show that $c^l_{D1} < c^l_{D0}$ for the short-run case, which then implies that $c^l_{D1} < m^l$.

To show that $c^l_{X1} < c^l_{D1}$ for the short-run, we can manipulate the expression for $c^h_{D1} = \tau^h_1 c^l_{X1}$.

$$\begin{aligned}
\frac{\alpha - \tau^h_1 c^l_{X1}}{(\tau^h_1 c^l_{X1})^{k+1}} &= \frac{\eta}{2(k+1)\gamma}\left(\frac{N^h_{D0}}{(c^h_{D0})^k} + (\tau^h_1)^{-k}\frac{N^l_{D0}}{(c^l_{D0})^k}\right) \longleftrightarrow \\
\frac{\alpha - \tau^h_1 c^l_{X1}}{\tau^h_1 (c^l_{X1})^{k+1}} &= \frac{\eta}{2(k+1)\gamma}\left((\tau^h_1)^k\frac{N^h_{D0}}{(c^h_{D0})^k} + \frac{N^l_{D0}}{(c^l_{D0})^k}\right) \longleftrightarrow \\
\frac{\frac{\alpha}{\tau^h} - c^l_{X1}}{(c^l_{X1})^{k+1}} &= \frac{\eta}{2(k+1)\gamma}\left(\frac{N^l_{D0}}{(c^l_{D0})^k} + (\tau^h_1)^k\frac{N^h_{D0}}{(c^h_{D0})^k}\right)
\end{aligned}$$

Comparing this implicit solution for c^l_{X1} to the solution to c^l_{D1} above, there are only two differences. First, the right side is larger because $(\tau^h_1)^k > (\tau^l_1)^{-k}$, and both τ^l_1 and

τ_1^h are greater than one. Second, $\alpha > \frac{\alpha}{\tau^h}$. On inspection, both of these differences ensure that $c^l_{X1} < c^l_{D1}$. Note that an identical proof holds for trade costs if ν is substituted for τ everywhere.

$\underline{c^l_{D1} < c^l_{D0}}$: As originally shown in Melitz and Ottaviano (2008), this is not necessarily the case in the long-run. This will be addressed below. For now, we consider the case of $c^l_D < c^l_A$ in the long-run. The structure of the proof is as follows: $\{N^l_E > 0, N^h_E > 0\} \longrightarrow \{0 < c^l_D, 0 < c^h_D\} \longleftrightarrow \{\rho^h < \frac{\phi^l}{\phi^h}, \rho^l < \frac{\phi^h}{\phi^l}\} \longleftrightarrow \{c^l_D < c^l_A, c^h_D < c^h_A\}$.

The first part of this chain of reasoning (positive entry implies positive cutoffs) was proven already. Now let's examine the assumption that $0 < c^l_D$. Writing out the full solution for c^l_D reveals:

$$\begin{aligned} 0 &< c^l_D \\ 0 &< \left(\frac{\gamma}{L^l}\frac{\phi^l - \rho^h\phi^h}{1-\rho^h\rho^l}\right)^{\frac{1}{k+2}} \\ \rho^h &< \frac{\phi^l}{\phi^h} \end{aligned}$$

Note that because $1-\rho^h\rho^l$, L^l and γ are all positive, this inequality is a necessary and sufficient condition for $0 < c^l_D$. In addition, $0 < c^h_D \longleftrightarrow \rho^l < \frac{\phi^h}{\phi^l}$.

Finally, let's examine the assumption that $c^l_D < c^l_A$. Writing out the full forms of the cutoffs and simplifying yields the following:

$$\begin{aligned} c^l_D &< c^l_A \\ \left(\frac{\gamma}{L^l}\frac{\phi^l - \rho^h\phi^h}{1-\rho^h\rho^l}\right)^{\frac{1}{k+2}} &< \left(\frac{\gamma\phi^l}{L^l}\right)^{\frac{1}{k+2}} \\ \rho^h\rho^l &< \rho^h\frac{\phi^h}{\phi^l} \\ \rho^l &< \frac{\phi^h}{\phi^l} \end{aligned}$$

This is again a necessary and sufficient condition for $c_D^l < c_A^l$. Similarly, $c_D^h < c_A^h \longleftrightarrow \frac{\phi^h}{\phi^l} < \rho^h$. Therefore, $0 < c_D^l$ and $0 < c_D^h$ jointly guarantee $c_D^l < c_A^l$ and $c_D^h < c_A^h$.

A similar chain of reasoning can be used to show that $c_D^l < c_A^l$ in the case of a non-tariff variable trade cost by replacing ρ^l with σ^l in the proof above. We already demonstrated that $c_D^l < c_A^l$ in the short-run case in Appendix A2.

For the short-run case, note that we have $\bar{m}^l = c_{D0}^l$, the long-run cutoff pre-liberalization, while c_{D1}^l is the short-run cutoff post-liberalization. Tariffs go from τ_0^l to $\tau_1^l < \tau_0^l$. (Moving from autarky to trade is simply a special case of reducing trade barriers in an already open economy.)

The equilibrium condition which determines c_{D1}^l is then:

$$\frac{\alpha - c_{D1}^l}{(c_{D1}^l)^{k+1}} = \frac{\eta}{2(k+1)\gamma} \left(\frac{N_{D0}^l}{(c_{D0}^l)^k} + (\tau_1^l)^{-k} \frac{N_{D0}^h}{(c_{D0}^h)^k} \right)$$

If $\tau_1^l = \tau_0^l$ then the distribution and number of entrants is consistent with the original long-run equilibrium and therefore $c_{D1}^l = c_{D0}^l$. However, if $\tau_1^l < \tau_0^l$ the right side of this expression becomes larger and therefore $c_{D1}^l < c_{D0}^l$. This is simply a special case of the fact that all short-run reductions in trade barriers reduce the domestic productivity cutoff, which is shown in the original paper.

$\underline{c^h_{X0} < c^h_{X1}}$: For the long-run case, we have:

$$\begin{aligned}
c^l_{X0} &< c^l_{X1} \\
\frac{1}{\tau^l_0}\left(\frac{\gamma}{L^l}\frac{\phi^l - \rho^h_0\phi^h}{1-\rho^h_0\rho^l_0}\right)^{\frac{1}{k+2}} &< \frac{1}{\tau^l_1}\left(\frac{\gamma}{L^l}\frac{\phi^l - \rho^h_1\phi^h}{1-\rho^h_1\rho^l_1}\right)^{\frac{1}{k+2}} \\
\longleftrightarrow \frac{1-\rho^h_1\rho^l_1}{1-\rho^h_0\rho^l_0} &< \frac{\phi^l - \rho^h_1\phi^h}{\phi^l - \rho^h_0\phi^h}\left(\frac{\tau^l_0}{\tau^l_1}\right)^{k+2} \\
\frac{1-\rho^h_1\rho^l_1}{1-\rho^h_0\rho^l_0} &< \frac{\rho^h_1\frac{\phi^l}{\phi^h} - \rho^h_1\rho^l_1}{\rho^h_0\frac{\phi^l}{\phi^h} - \rho^h_0\rho^l_0}\left(\frac{\tau^l_0}{\tau^l_1}\right)
\end{aligned}$$

Recall from earlier that positive entry in h implies $\rho^h\frac{\phi^l}{\phi^h} < 1$. Using this, and the fact that $\tau^l_0 > \tau^l_1$ it is clear that the presumed inequality holds. An analagous proof holds for the case of NTBs.

For the short-term case we can start with the expression for c^l_{X1}.

$$\frac{\alpha - \tau^h_1 c^l_{X1}}{(\tau^h_1 c^l_{X1})^{k+1}} = \frac{\eta}{2(k+1)\gamma}\left(\frac{N^h_{D0}}{(c^h_{D0})^k} + (\tau^h_1)^{-k}\frac{N^l_{D0}}{(c^l_{D0})^k}\right)$$

c^l_{X1} is a function of τ^h_l, and we have a sequence of pairs ranging between $\{\tau^h_0, c^l_{X0}\}$ and $\{\tau^h_1, c^l_{X1}\}$. We want to check that a generic c^l_X is increasing for every tariff rate τ^h between τ^h_0 and τ^h_1. Using the implicit function theorem, we have:

$$\begin{aligned}
\frac{dc^l_X}{d\tau^h_1} &= -\frac{\frac{c^l_X}{(\tau^h c^l_X)^{k+1}} + (k+1)c^l_X\frac{\alpha-\tau^h c^l_X}{(\tau^h c^l_X)^{k+2}} - k(\tau^h)^{-k-1}\frac{N^l_{D0}}{(c^l_{D0})^k}\frac{\eta}{2(k+1)\gamma}}{\frac{\tau^h}{(\tau^h c^l_X)^{k+1}} + (k+1)\tau^h\frac{\alpha-\tau^h c^l_X}{(\tau^h c^l_X)^{k+2}}} \\
&= -\frac{\frac{c^l_X}{(\tau^h c^l_X)^{k+1}} + \frac{k+1}{\tau^h}\frac{\alpha-\tau^h c^l_X}{(\tau^h c^l_X)^{k+1}} - \frac{k}{\tau^h}\left(\frac{\alpha-\tau^h c^l_X}{(\tau^h c^l_X)^{k+1}} - \frac{\eta}{2(k+1)\gamma}\frac{N^h_{D0}}{(c^h_{D0})^k}\right)}{\frac{\tau^h}{(\tau^h c^l_X)^{k+1}} + (k+1)\tau^h\frac{\alpha-\tau^h c^l_X}{(\tau^h c^l_X)^{k+2}}}
\end{aligned}$$

This will be negative as long as $\alpha - \tau^h c^l_X$ is positive, which means that c^l_X increases as τ^h decreases. Using the equilibrium condition for c^l_X in the short-term, it is clear that $\alpha - \tau^h c^l_X$ must be positive because the right-hand side is positive for all $\tau^h \in [\tau^h_1, \tau^h_0]$. Therefore, $c^l_{X1} > c^l_{X0}$.

Examining unilateral and asymmetric liberalization in the long-run: First, let's consider the case of a firm in l in the range (c^l_X, c^l_D). I'll differentiate their profits with respect to ρ^l, so if profits are decreasing in ρ^l they will be increasing in τ^l.

$$\begin{aligned}\frac{\partial \pi^l(c)}{\partial \rho^l} &= -\frac{L^l}{2\gamma}(c^l_D - c)\frac{\partial c^l_D}{\partial \rho^l} \\ &= \frac{L^l}{2\gamma}(c^l_D - c)(c^l_D)\frac{1}{k+2}\frac{\rho^h}{1-\rho^l\rho^h}.\end{aligned}$$

Because $c < c^l_D$ this is positive. An increase in ρ^l is equivalent to a decrease in τ^l therefore profits for any firms with $c \in (c^l_X, c^l_D)$ are increasing in small reductions in τ^l, holding τ^h constant.

Now we consider a firm with c in the range $(0, c^l_X)$.

$$\frac{\partial \pi^l(c)}{\partial \rho^l} = -\frac{L^h}{2\gamma}\tau^h(c^l_X - c)\frac{\partial c^l_X}{\partial \rho^l} - \frac{L^l}{2\gamma}(c^l_D - c)\frac{\partial c^l_D}{\partial \rho^l}$$

where

$$\frac{\partial c^l_X}{\partial \rho^l} = (c^h_D)^{-k-1}(c^l_D)^{k+2}\frac{L^l}{\tau^h L^h}\frac{1}{k+2}\frac{1}{1-\rho^l\rho^h}.$$

Plugging the latter expression along with the explicit form of $\frac{\partial c^l_D}{\partial \rho^l}$, and then simplifying extensively, we get the following necessary and sufficient condition for $\frac{\partial \pi^l(c)}{\partial \rho^l} > 0$:

$$\left(\frac{c^l_D}{c^l_X}\right)^{k+1} < \rho^h \frac{c^l_D - c}{c^l_X - c}.$$

This condition will always be met for $c = c^l_X$ (and other c to the left of this point), however because ρ^h is less than zero it cannot be met for $c = 0$. The equivalent condition for the NTB case replaces ρ^h with σ^h.

What if we were to artificially restrict attention to long-run liberalizations in which $c^l_{D1} < c^l_{D0}$? After some simplification, this implies the following:

$$\frac{\left(\frac{m^l}{m^h}\right)^k - \rho^h_1}{\left(\frac{m^l}{m^h}\right)^k - \rho^h_0} < \frac{1-\rho^h_1\rho^l_1}{1-\rho^h_0\rho^l_0}$$

Recall that $\rho^l = (\tau^l)^{-k-1}$ is a measure of the freeness of trade in l. ρ^l is replaced with $\sigma^l = (\nu^l)^{-k}$ for the case of non-tariff barriers, but the same argument holds. This restriction then requires that τ^l_1 not be too low or τ^l_0 too high. In words, there is a breaking point at which country l lowers its trade barriers too much relative to the status quo leading to the relocation effect in h described above. Similarly, if τ^h_1 is not sufficiently lower than τ^h_0, then the pressures for firms to locate in h will lead to reduced competition in l, and greater profits for l's domestic-only producers. Finally, note that if $\frac{m^l}{m^h}$ becomes larger (indicating that l's firms are relatively less productive on average), l's trade concessions must be higher to ensure that this condition holds. All of these conditions boil down to the requirement that the proposed trade liberalization not be 'too unequal' conditional on the comparative advantage of the two sides.

A2: The percentage change in profits as a function of c

We wish to show that near $c = 0$, the percentage and absolute change in profits is decreasing in c for the autarky-to-trade case, and increasing in c for the restricted-to-freer-trade case.

Autarky to trade case: The percentage change in profits relative to autarky is $\frac{\Delta\pi(c)}{\pi_A(c)}$, and we need to search in the range $(0, c_X^l)$ where

$$\begin{aligned}\frac{\Delta\pi(c)}{\pi_A(c)} &= \frac{\frac{L^h}{4\gamma}\tau^h(c_X^l - c)^2 + \frac{L^l}{4\gamma}(c_D^l - c)^2 - \frac{L^l}{4\gamma}(c_A^l - c)^2}{\frac{L^l}{4\gamma}(c_A^l - c)^2} \\ &= \frac{L^h}{L^l}\tau^h\frac{(c_X^l - c)^2}{(c_A^l - c)^2} + \frac{(c_D^l - c)^2}{(c_A^l - c)^2} - 1\end{aligned}$$

Taking the derivative of both sides and then multiplying by $(c_A^l - c)^3$ (which is positive in the range $[0, c_X^l]$) we get the following condition for $\frac{\Delta\pi(c)}{\pi_A(c)}$ to be decreasing in c:

$$\frac{L^h}{L^l}\tau^h(-2(c_X^l - c)(c_A^l - c) + 2(c_X^l - c)^2) + (-2(c_D^l - c)(c_A^l - c) + 2(c_D^l - c)^2) < 0.$$

Because $c_A^l > c_X^l$ and $c_A^l > c_D^l$ both terms will be negative for any value of $c \in [0, c_X^l]$. Because the percentage increase in profits is decreasing over the admissible range, it must be maximized at 0. Hence, more productive firms in the range $(0, c_X^l)$ gain more as a proportion of pre-liberalization profits from trade liberalization. The same proof holds for the case of NTBs, in which case τ^h is replaced with $(\nu^h)^2$.

To see that the greatest increase in profits goes to the firm $c = 0$, if any firm benefits from trade, note that the second derivative of $\Delta\pi^l(c)$ on the range $[0, c_X^l]$ for the tariff case is

$$\frac{\partial^2\Delta\pi(c)}{\partial c^2} = \frac{L^h}{2\gamma}\tau^h > 0.$$

(For the NTB case replace τ^h with $(\nu^l)^2$.) Because $\Delta\pi^l(c)$ is a quadratic function, this implies that it has no interior maximum so we look at the endpoints for a maximum. $\Delta\pi^l(c_X^l) < 0$, so it must be the case that $c = 0$ benefits from trade, if any firm does. Also, $\frac{\partial\Delta\pi(c)}{\partial c} > 0$ at c_X^l so all of the proceeding facts require that $\frac{\partial\Delta\pi(c)}{\partial c} < 0$ in the neighborhood of $c = 0$ if any firm benefits from trade.

Restricted-to-freer-trade case: I will start with the tariff case. We wish to show that $\lim_{c\to+0}\frac{\partial\Delta\pi^l(0)}{\partial c} > 0$.

$$\begin{aligned}\lim_{c\to+0}\frac{\partial\Delta\pi^l(0)}{\partial c} &= -\frac{L^h}{2\gamma}\tau_1^h(c^l_{X1}-c)+\frac{L^h}{2\gamma}\tau_0^h(c^l_{X0}-c)-\frac{L^l}{2\gamma}(c^l_{D1}-c)+\frac{L^l}{2\gamma}(c^l_{D0}-c)\\ &= -\frac{L^h}{2\gamma}(c^h_{D1})+\frac{L^h}{2\gamma}(c^h_{D0})-\frac{L^l}{2\gamma}(c^l_{D1})+\frac{L^l}{2\gamma}(c^l_{D0})\end{aligned}$$

This will be positive, because of the ordering of domestic cutoffs which has already been demonstrated.

The equivalent condition for the NTB case is:

$$\begin{aligned}\lim_{c\to+0}\frac{\partial\Delta\pi^l(0)}{\partial c} &= -\frac{L^h}{2\gamma}(\nu_1^h)^2(c^l_{X1}-c)+\frac{L^h}{2\gamma}(\nu_0^h)^2(c^l_{X0}-c)-\frac{L^l}{2\gamma}(c^l_{D1}-c)+\frac{L^l}{2\gamma}(c^l_{D0}-c)\\ &= -\frac{L^h}{2\gamma}\nu_1^h c^h_{D1}+\frac{L^h}{2\gamma}\nu_0^h c^h_{D0}-\frac{L^l}{2\gamma}c^l_{D1}+\frac{L^l}{2\gamma}c^l_{D0}\end{aligned}$$

The second half will always be positive, but the sign on the first half is ambiguous. A sufficient condition for the overall expression to be positive is $-\nu_1^h c^h_{D1}+\nu_0^h c^h_{D0} > 0$. This provides an analytically tractable expression for the short-run case. First, note that when $\nu_1^h=\nu_0^h$, $-\nu_1^h c^h_{D1}+\nu_0^h c^h_{D0}=0$, and that as ν_1^h decreases the second term will not change. We can examine the sign of $\frac{d(-\nu_1^h c^h_{D1})}{d\nu_1^h}$ to see if our sufficient condition will be met. It will be if $\frac{d(-\nu_1^h c^h_{D1})}{d\nu_1^h} < 0$. We will check the sign of this derivative across a range of liberalizations going from $\{\nu_0^h, c^l_{X0}\}$ to $\{\nu_1^h, c^l_{X1}\}$ and show that it is negative everywhere. We will phrase the derivative in terms of a generic $\{\nu^h, c_X^l\}$ pair that lies in this range.

$$\begin{aligned}
\frac{\partial(-\nu^h c_D^h)}{\partial \nu^h} &= -c_D^h - \nu^h \frac{\partial c_D^h}{\partial \nu^h} \\
&= -c_D^h - \nu^h \frac{\frac{\eta}{2(k+1)\gamma}\left(\frac{N_{D0}^l}{(c_{D0}^l)^k}(\nu^h)^{-k-1}k\right)}{\frac{-1}{(c_D^h)^{k+1}} - (k+1)\frac{\alpha - c_D^h}{(c_D^h)^{k+2}}} \\
&= -\frac{\frac{c_D^h}{(c_D^h)^{k+1}} + (k+1)\frac{\alpha - c_D^h}{(c_D^h)^{k+1}} - k\left(\frac{\alpha - c_D^h}{(c_D^h)^{k+1}} - \frac{\eta}{2(k+1)\gamma}\frac{N_{D0}^h}{(c_{D0}^h)^k}\right)}{\frac{1}{(c_D^h)^{k+1}} + (k+1)\frac{\alpha - c_D^h}{(c_D^h)^{k+2}}}
\end{aligned}$$

This expression is negative everywhere and so we can confirm that in the case of short-run decreases in NTBs, $\Delta\pi^l(c)$ is increasing in c in the neighborhood of $c = 0$.

Now examining percentage changes in profits: profits in the pre-liberalization equilibrium are decreasing in c, so $c = 0$ is the most profitable firm. If $c = 0$ has positive gains from the trade liberalization and $c = 0$'s gains are not the greatest in absolute terms (as shown above) than it must be the case the $c = 0$'s percentage gains from liberalization are not the greatest.

A3: Circumstances under which no firms support trade liberalization

Autarky-to-trade case: Because of Claim 1a, we can focus on the profits of the most productive firm which are given by

$$\Delta\pi^l(c) = \frac{L^h}{4\gamma}\tau^h(c_X^l - c)^2 + \frac{L^l}{4\gamma}(c_D^l - c)^2 - \frac{L^l}{4\gamma}(c_A^l - c)^2.$$

From the implicit solutions of the cutoffs, its clear that the only impact of a reduction in domestic trade barriers is to decrease c_D^l. Reducing τ^l or ν^l therefore lowers the profits of all firms. At some point, this may push every firm in l into losses from the trade liberalization, although it may not because there are still gains from an increase in exports.

Appendix A6 contains a proof that in the tariff case, an increase in τ^h reduces every exporting firm's profits in the foreign market. A sufficiently large increase *will* push all of l's firms into losses, because domestic profits always decrease in the wake of trade liberalization and increasing τ^h arbitrarily pushes exporting profits to zero. The equivalent result does not hold for the NTB case.

A drop in either m^h or f_E^h reduces both c_X^l and c_D^l, via the term $\frac{N_A^h}{(c_D^h)^k} \propto \frac{\alpha - c_A^h}{(c_A^h)^{k+1}}$. This is because the autarky cutoff, $c_A^h = \frac{\gamma \phi^h}{L^h}$, is decreasing increasing in m^h and f_E^h. Because m^h and f_E^h can be pushed to zero (which pushes the cutoff c_A^h to zero and increases entry), reductions in these parameters are sufficient to ensure that no firm in l benefits from trade.

We can now consider m^l and f_E^l but they have slightly trickier effects. To treat both at the same time, let's consider an increase in $\phi^l = 2(k+1)(k+2)(m^l)^k f_E^l$. This makes l's firms less competitive. Again focusing on the most productive firm, the change in profits associated with an increase in ϕ^l is:

$$\frac{\partial \Delta \pi^l(c=0)}{\partial \phi^l} = \frac{L^h}{2\gamma}\tau^h(c_X^l)\frac{\partial c_X^l}{\partial \phi^l} + \frac{L^l}{2\gamma}(c_D^l)\frac{\partial c_D^l}{\partial \phi^l} - \frac{L^l}{2\gamma}(c_A^l)\frac{\partial c_A^l}{\partial \phi^l}.$$

This is potentially ambiguous, because each of the partial derivatives is positive. For example, a reduction in l's competitiveness might not be such a bad thing if the economy is still heavily protected after liberalization but it could be disastrous if the economy is heavily exposed to foreign competition. We can consider changes in the trade policy to find some extreme cases where the results are clear.

First, consider a reduction in l's own trade barriers. This affects only the term

$\frac{L^l}{2\gamma}(c_D^l)\frac{\partial c_D^l}{\partial \phi^l}$. This term is proportional to

$$c_D^l \frac{\partial c_D^l}{\partial \phi^l} = \frac{\left(\frac{1}{(c_A^l)^{k+1}} + \frac{(\alpha - c_A^l)(k+1)}{(c_A^l)^{k+2}}\right)\frac{\partial c_A^l}{\partial \phi^l}}{\frac{1}{(c_D^l)^k} + \frac{(\alpha - c_D^l)(k+1)}{(c_D^l)^{k+1}}}.$$

Because a reduction in τ^l will decrease c_D^l, this term will be decreasing in τ^l.

Similarly, we can consider an increase in h's trade barriers. This affects only the first term, which is proportional to

$$\tau^h c_D^h \frac{\partial c_D^h}{\partial \phi^l} = (\tau^h)^{-k+1} \frac{\left(\frac{1}{(c_A^l)^{k+1}} + \frac{(\alpha - c_A^l)(k+1)}{(c_A^l)^{k+2}}\right)\frac{\partial c_A^l}{\partial \phi^l}}{\frac{1}{(c_D^h)^k} + \frac{(\alpha - c_D^h)(k+1)}{(c_D^h)^{k+1}}}.$$

This expression is not necessarily decreasing in τ^h, but it converges to zero as $\tau^h \to \infty$ because c_D^h is always positive. Finally, note that

$$c_D^l \frac{\partial c_D^l}{\partial \phi^l} < c_A^l \frac{\partial c_A^l}{\partial \phi^l}$$

because $c_D^l < c_A^l$. This means the final two terms are always negative. A sufficiently large increase in τ^h will therefore ensure that the most productive firm's profits are decreasing in ϕ^l.

Finally, we can consider the interaction of ϕ^l and ϕ^h. As $\phi^h \to 0$, meaning that h's firms get more efficient, $c_D^l \frac{\partial c_D^l}{\partial \phi^l}$ and $\tau^h c_D^h \frac{\partial c_D^h}{\partial \phi^l}$ both limit out at 0. Because the final term of $\frac{\partial \Delta \pi^l(c=0)}{\partial \phi^l}$ does not vary with ϕ^h and is negative, $\frac{\partial \Delta \pi^l(c=0)}{\partial \phi^l}$ is negative in the limit.

In contrast, as ϕ^h increases arbitrarily, c_A^h will be pushed to its limit at α, at which point there will be no entry in h. This in turn implies that $c_D^l = c_A^l$, so the second and third cancel. Note, furthermore, that c_D^h will still be positive, therefore $\frac{\partial \Delta \pi^l(c=0)}{\partial \phi^l}$ will be positive as well.

Now consider increasing L^h arbitrarily.

$$\begin{aligned}\lim_{L^h\to\infty}\left(\Delta\pi^l(c=0)\right) &= \lim_{L^h\to\infty}\left(\frac{L^h}{4\gamma}\tau^h(c_X^l)^2+\frac{L^l}{4\gamma}(c_D^l)^2-\frac{L^l}{4\gamma}(c_A^l)^2\right)\\ &= \lim_{L^h\to\infty}\frac{L^h}{4\gamma}\frac{1}{\tau^h}(c_D^h)^2+0-\frac{L^l}{4\gamma}(c_A^l)^2\end{aligned}$$

The first term's sign isn't clear because $\lim_{L^h\to\infty} c_D^h = 0$. Using L'Hopital's rule

$$\begin{aligned}\lim_{L^h\to\infty}\frac{L^h}{(c_D^h)^{-2}} &= \lim_{L^h\to\infty} -2(c_D^h)^3\frac{\partial c_D^h}{\partial L^h}\\ &= \lim_{L^h\to\infty}\left(2(c_D^h)^3\frac{\frac{1}{(c_A^h)^{k+1}}+\frac{(\alpha-c_A^h)(k+1)}{(c_A^h)^{k+2}}}{\frac{1}{(c_D^h)^{k+1}}+\frac{(\alpha-c_D^h)(k+1)}{(c_D^h)^{k+2}}}\frac{c_A^h}{k+2}\frac{1}{L^h}\right)\\ &= \lim_{L^h\to\infty}\left(2(c_D^h)^3\left(\frac{c_D^h}{c_A^h}\right)^{k+2}\frac{\alpha k+\alpha-c_A^h k}{\alpha k+\alpha-c_D^h k}\frac{c_A^h}{k+2}\frac{1}{L^h}\right)\end{aligned}$$

This expression is 0 in the limit, because $c_A^h > c_D^h$, so the second and third chunks don't diverge; and because c_D^h, c_A^h and, $\frac{1}{L^h}$ are all zero in the limit.

<u>Restricted-to-freer-trade case</u>: The change in profits from trade liberalization for an exporter is

$$\Delta\pi^l(c)=\frac{L^h}{4\gamma}\tau_1^h(c_{X1}^l-c)^2+\frac{L^l}{4\gamma}(c_{D1}^l-c)^2-\frac{L^h}{4\gamma}\tau_0^h(c_{X0}^l-c)^2-\frac{L^l}{4\gamma}(c_{D0}^l-c)^2$$

Note that c_D^l alone is increasing in τ_1^l, so $\Delta\pi^l(c)$ decreases for all firms as τ_1^l decreases. Some exporters may still benefit from an increase in access abroad, so reductions in τ_1^l are not necessarily sufficient to ensure that no firm supports trade liberalization.

Increasing τ_1^h leads to a reduction in profits for all exporters, although only in the tariffs case. This proof is left until Appendix A6. Because exports are the only source of increased profits, such a change will be sufficient to ensure that no firm support trade liberalization (e.g. if τ_1^h is only slightly lower than τ_0^h).

A4: Only one dividing line between trade coalitions

Autarky-to-trade case: There are two cases two consider. First, if $\Delta\pi^l(0) > 0$. We also know that $\Delta\pi^l(c^l_X) < 0$. $\Delta\pi^l$ is a quadratic function of c in the range $[0, c^l_X]$, and is therefore continuous. Appealing to the intermediate value theorem, then, there must be at least one $\tilde{c} \in [0, c^l_X]$ such that $\Delta\pi^l(\tilde{c}) = 0$. To see that there is *only* one such $\tilde{c}$ note that an even number of crossings is ruled out by the relative values of these functions at their endpoints, and 3 or more crossings of these functions would require inflection points (which a quadratic does not have). The second case is if $\Delta\pi^l(0) \leq 0$. Note that $\Delta\pi^l(c)$ is decreasing in c near $c = 0$. We still have $\Delta\pi^l(c^l_X) < 0$, and the lack of inflection points in a quadratic function imply that $\Delta\pi^l(c)$ cannot decrease near $c = 0$, rise above the zero line, and then decrease again to $\Delta\pi^l(c^l_X)$. So if $c = 0$ does not support the liberalization, there are no supporters.

Restricted-to-freer trade case: We are going to examine $\Delta\pi^l(c)$ in the range $(0, c^l_{X1}]$ to establish that this function has at most two roots on this domain, which is sufficient to show that the range of supporters is continuous. First, I focus on the range (c^l_{X0}, c^l_{X1}). The derivative $\Delta\pi^l(c)$ at c^l_{X1} is

$$\begin{aligned}
\frac{\partial \Delta\pi^l(c)}{\partial c} &= -\frac{L^h}{2\gamma}\tau^l_1(c^l_{X1} - c) - \frac{L^l}{2\gamma}(c^l_{D1} - c) + \frac{L^l}{2\gamma}(c^l_{D0} - c) \\
&= -\frac{L^l}{2\gamma}(c^l_{D1} - c^l_{X1}) + \frac{L^l}{2\gamma}(c^l_{D0} - c^l_{X1})
\end{aligned}$$

which is positive because $c^l_{D0} > c^l_{D0}$. We also know that $\Delta\pi^l(c^l_{X1}) < 0$. Owing to the quadratic shape of the piecewise function $\Delta\pi^l(c)$ on (c^l_{X0}, c^l_{X1}), there can be at most one root on this range.

There are two cases to examine on the range $(0, c^l_{X0}]$: $\Delta\pi^l(0) < 0$ and $\Delta\pi^l(0) > 0$. If $\Delta\pi^l(0) < 0$, then there can be up to two roots on the range $(0, c^l_{X0}]$. However, the signs for $\Delta\pi^l(0)$ at the endpoints of the range $(0, c^l_{X1}]$ indicate that there must be an even number of roots. Therefore, there is either one root in the range $(0, c^l_{X0}]$ and one in $(c^l_{X0}, c^l_{X1}]$ or two roots in the range $(0, c^l_{X0}]$. Either way the range of supporters is continuous.

If $\Delta\pi^l(0) > 0$, then we use the fact that $\frac{\partial \Delta\pi^l(c)}{\partial c} > 0$ at $c = 0$ which was demonstrated in Appendix A4. This implies that there is at most one root on the range $(0, c^l_{X0}]$. Using the signs of the endpoints of the range, there can be only one root in $(0, c^l_{X1}]$. The range of supporters is continuous between 0 and this one root.

A5: Conditions for the Most Productive Firms to Oppose Tariff Liberalization

For a reduction in tariffs, the change in profits induced by a trade liberalization for the most productive firm is:

$$\begin{aligned}
\Delta\pi^l(0) &= \frac{L^h}{4\gamma}\tau^h_1(c^l_{X1})^2 + \frac{L^l}{4\gamma}(c^l_{D1})^2 - \frac{L^h}{4\gamma}\tau^h_0(c^l_{X0})^2 - \frac{L^l}{4\gamma}(c^l_{D0})^2 \\
&= \frac{1}{\tau^h_1}\frac{L^h}{4\gamma}(c^h_{D1})^2 - \frac{1}{\tau^h_0}\frac{L^h}{4\gamma}(c^h_{D0})^2 + \frac{L^l}{4\gamma}(c^l_{D1})^2 - \frac{L^l}{4\gamma}(c^l_{D0})^2
\end{aligned}$$

Because $\tau^h_1 < \tau^h_0$, $\Delta\pi^l(0)$ may be positive or negative. A sufficient, but not necessary, condition for the most productive firm to oppose a bilateral reduction in tariffs is $\frac{(c^h_{D1})^2}{\tau^h_1} < \frac{(c^h_{D0})^2}{\tau^h_0}$.

After simplifying and rearranging, the condition is equivalent to:

$$\left(\frac{\tau^h_1}{\tau^h_0}\right)\left(\frac{1-\rho^h_1\rho^l_1}{1-\rho^h_0\rho^l_0}\right)^{\frac{2}{k+2}} > \left(\frac{\left(\frac{m^h}{m^l}\right)^k - \rho^l_1}{\left(\frac{m^h}{m^l}\right)^k - \rho^l_0}\right)^{\frac{2}{k+2}}.$$

Clearly, this condition will be met if τ_0^h is sufficiently small or τ_1^h sufficiently big. Recall that Appendix A3 demonstrated that $\rho^h < \left(\frac{m^l}{m^h}\right)^k$ therefore this condition will be met if τ_1^l is sufficiently small and τ_0^l is sufficiently big. The condition can also be met by increasing m^l and by decreasing m^h.

In the short term, this condition has no closed form to permit analysis. However, it is clear that if τ_1^l (which affects an l exporter's bottom line only by reducing c_{D1}^l) is too low, than it is possible to make $c = 0$ not profit from trade liberalization.

A6: Exporters may support NTBs in their export market

The exporting profits of a firm in l which sells in h are given by $\frac{L^h}{4\gamma}(\nu^h)^2(c_X^l - c)^2$ and the change induced by a small increase in ν^l is

$$\frac{\partial \pi_X^l}{\partial \nu^h} = c_D^h \frac{\partial c_D^h}{\partial \nu^h} - c_D^h c - \nu^l c \frac{\partial c_D^h}{\partial \nu^h} + 2\nu^l c^2.$$

Clearly as $c \to 0$ this will equal $c_D^h \frac{\partial c_D^h}{\partial \nu^h}$, which is strictly positive because the short-term domestic productivity cutoff is increasing in home-country trade barriers. Strict positivity and continuity guarantee that there is a range of productive firms whose profits from exporting increase. At the same time, there is no change in domestic profits so these firms support a unilateral increase in profits in their export market.

To see that lower productivity firms will oppose a unilateral increase in trade barriers in their export market, consider the firms in the range $c \in [c_{X1}^l, c_{X0}^l]$ where time one represents the equilibrium after the increase in trade barriers. All of these firms will lose out from the growth in trade barriers. The firm with $c = c_{X1}^l$ will have a strictly negative change in profits. Again appealing to continuity of $\Delta\pi(c)$

there will be some firms which continue to export who oppose the increase in trade barriers.

Now turning to the tariff case, the profits for an exporter from l to h from exporting are $\frac{L^h}{4\gamma}(\tau^h)(c^l_X - c)^2$. Then, $\frac{\partial \pi^l_X}{\partial \tau^h} \propto (c^l_X)^2 + 2\tau^h c^l_X \frac{\partial c^l_X}{\partial \tau^h} - 2c^l_X c - 2\tau^h c \frac{\partial c^l_X}{\partial \tau^h} + c^2$. It is therefore possible that $\frac{\partial \pi^l_X}{\partial \tau^h}$ is decreasing in c entirely, decreasing and then increasing in c, or increasing in c entirely (because it is quadratic in c). We therefore must check the signs at its endpoints 0 and c^l_X: if they are both negative then no firm gains from an increase in tariffs.

Firms in the vicinity of c^l_X must lose from an increase in tariff barriers because a small increase in tariffs reduces c^l_X slightly leading to a reduction in profits. For example, at time one a firm with $c = c^l_{X1}$ clearly faces a loss in profits because it was earning positive profits when the cutoff was $c^l_{X0} > c^l_{X1}$. Again relying on continuity, a firm an epsilon to the left of this firm in the cost distribution must also lose from greater tariffs, therefore $\frac{\partial \pi^l_X}{\partial \tau^h}$ is negative near $c = 0$.

Next, we'll examine the change in profits for the firm at $c = 0$. I will look at the derivative of this firm's profits with respect to c^h_D, which is equivalent to an increase in τ^h and slightly easier to handle. Note that τ^h is an explicit function determined by c^h_D.

$$
\begin{aligned}
\frac{\partial \pi^l_X(c=0)}{\partial c^h_D} &= -\frac{L^h}{4\gamma}(c^l_X)^2 \frac{\partial \tau^h}{\partial c^h_D} + \frac{2L^h}{4\gamma} c^l_X \\
&\propto -\frac{1}{4}\left(\tau^h\right)^{k+1} \left(\frac{(m^l)^k}{N^l_D} \frac{2(k+1)\gamma}{\eta} \left(\frac{c^h_D}{(c^h_D)^{k+2}} + (k+1)\frac{\alpha - c^h_D}{(c^h_D)^{k+2}} \right) \right) + \frac{1}{2}\frac{\tau^h}{c^h_D} \\
&= \frac{1}{4}\left(\frac{2(k+1)\gamma}{\eta} \left(\frac{-\alpha k - \alpha + k c^h_D}{(c^h_D)^{k+2}} \right) \right) \\
&\quad + \frac{1}{4}\left(\frac{2(k+1)\gamma}{\eta} \frac{2(\alpha - c^h_D)}{(c^h_D)^{k+2}} - \frac{N^h_D}{(m^h)^k} \frac{2}{c^h_D} \right)
\end{aligned}
$$

A sufficient condition for this to be negative is $(k-2)(c_D^h-\alpha)-\alpha < 0$. We know from the definition of c_D^h that $c_D^h - \alpha < 0$, so we only need to consider cases where $k < 2$. We have assumed that $k \geq 1$ and this expression at $k = 1$, where it is minimized, is $-c_D^h < 0$. Therefore, the most productive exporter in l does not benefit from an increase in tariffs in h. Increasing τ^l therefore amounts to a downward shift of the endpoints of the function $\pi_X^l(c)$.

A7: Decomposing the impact of changes in market size

For an exporting firm moving from autarky to trade, the change in profits from liberalization changes with an increase in L^l:

$$\frac{\partial \Delta \pi^l(c)}{\partial L^l} = \frac{L^h}{2\gamma}\tau^h(c_X^l-c)\frac{\partial c_X^l}{\partial L^l}+\frac{1}{4\gamma}(c_D^l-c)^2+\frac{L^l}{2\gamma}(c_D^l-c)\frac{\partial c_D^l}{\partial L^l}-\frac{1}{4\gamma}(c_A^l-c)^2-\frac{L^l}{2\gamma}(c_A^l-c)\frac{\partial c_A^l}{\partial L^l}.$$

The second and fourth terms represent the change in profits brought about by an increase in market size, assuming that all cutoffs remain unchanged. This is the 'market size effect'.

The other terms represent the consequences of changes in the cutoffs (note that each of the partial derivatives is negative). At root, they are all functions of the change in the autarky cutoff.

$$\frac{\partial c_X^l}{\partial L^l} = (\tau^h)^{-k+1}\frac{\left(\frac{1}{(c_A^l)^{k+1}}+\frac{(\alpha-c_A^l)(k+1)}{(c_A^l)^{k+2}}\right)}{\frac{1}{(c_D^h)^k}+\frac{(\alpha-c_D^h)(k+1)}{(c_D^h)^{k+1}}}\frac{\partial c_A^l}{\partial L^l}.$$

The form of $\frac{\partial c_D^l}{\partial L^l}$ is analagous. Recall that firm entry is not a function of L^l except via c_A^l so I refer to this latter effect as the firm entry or competitiveness effect. Increasing L^l decreases c_A^l which increases N_A^l.

A similar decomposition can be undertaken for changes in L^h.

A8: Implications of Equal Export Volumes

Total exports of l in a short-term equilibrium, which I will denote Π^l_X, are equal to $\frac{L^l}{\gamma\phi^l}\bar{N}^l_D(\nu^h)^{-k}(c^h_D)^{k+2}$. To maintain simplicity, I will assume that $\bar{N}^l_D$ is determined exogenously, although an identical proof works if we assume $\bar{N}^l_D = N^l_A$. Equality of exports combined with the fact that $\frac{\bar{N}^l_D}{(m^l)^k} > \frac{\bar{N}^h_D}{(m^h)^k}$, which is the condition for l to have a comparative advantage in the short-run, jointly imply that $(\nu^h)^{-k}(c^h_D)^{k+2} < (\nu^l)^{-k}(c^l_D)^{k+2}$ which on inspection implies that $\nu^h > \nu^l$. A similar set of steps is available to prove the tariff case.

Appendix B: Comparative Statics for Extent of Industry Support

Outline of Numerical Simulations

In order to search over a reasonable portion of the parameter space, it is necessary to cut down on the number of parameters. A number of restrictions can be made without loss of generality for the long-run case. First, the parameters α and η affect only the mass of entrants, not any of the cutoffs or proportions which are of interest. I therefore set $\alpha = 2$ and $\eta = 3$ for all simulations. Second, in the long-run, the parameters γ and f_E affect both the cutoffs and mass of entrants, but the proportionality of all cutoffs is preserved, so the nature of the results will be the same no matter what value is chosen. This is not true in the short-run because the cutoff solutions are less flexible but to limit the problem these parameters are not varied in the short-run. For these simulations, I set $\gamma = .5$ and $f_E = 1$.

For the case of moving from autarky to trade, this leaves only the six parameters which are permitted to differ between countries, (L^l,L^h,m^l,m^h,τ^l,τ^h) and k. I search over a grid constructed with the following ranges and number of points for each parameter.

Parameter	Range	Grid Points
L^l	$[400, 2000]$	5
L^h	$[400, 2000]$	5
m^l	$[2, 4]$	5
m^h	$[2, 4]$	5
τ^l	$[1.2, 3]$	5
τ^h	$[1.2, 3]$	5
k	$[2, 4]$	5

This grid thus evaluates the model at $5^7 = 78125$ points, although of course some of these violate Assumptions 1 or 2 and so any claims which rest on these assumptions are validated on a smaller number of points. The distribution of log sales and elasticity of substitution for these simulations are reasonably close to actual U.S. data. For example, the average elasticity of substitution across the simulations is 2.59 and Bernard, Redding and Schott (2008) use a figure of 3.8 for their simulations. The median skewness parameter is 3 and the same paper uses a parameter of 3.4. Finally, the standard deviations of log sales in the US is 1.66 in Bernard et al. (2003) and 1.23 here.

B1: Is there a supporter of trade liberalization?

To check that $c = 0$ supports opening the economy in the case of autarky-to-trade, I calculated the cutoffs at each point on the grid, and then checked if $\Delta\pi^l(c) > 0$. This was true in 94.3% of the simulated cases using non-tariff barriers and 91.7% of the cases using tariffs. The substantial difference between the two is likely because high productivity firms can benefit from trade barrier increases (See Appendix A6).

B2: Proportion of Supporters Comparative Statics

We are interested in how $p^l_{PT} \equiv \left(\frac{c^l_{PT}}{c^l_A}\right)^k$ varies with the main parameters. The strategy here involves three steps. First, differentiate p^l_{PT} with respect to a parameter ς, and develop a condition in terms of the sign of $\frac{\partial c^l_{PT}}{\partial \varsigma}$, in order to avoid directly working with the explicit solution of c^l_{PT}, which is analytically intractable. Second, use the implicit function theorem to develop a sufficient condition for the sign of $\frac{\partial c^l_{PT}}{\partial \varsigma}$. Third, and if necessary, evaluate this condition across an extensive grid of admissible parameter values generated in the same manner described at the beginning of Appendix B. Computational evaluation of these necessary conditions is required in most of these cases, but where analytical evaluation is possible, a complete proof will be given.

The term

$$\chi \equiv \frac{L^h}{2\gamma}\tau^h(c^l_X - c^l_{PT}) + \frac{L^l}{2\gamma}(c^l_D - c^l_{PT}) - \frac{L^l}{2\gamma}(c^l_A - c^l_{PT})$$

appears in the denominator of every derivative $\frac{\partial c^l_{PT}}{\partial \varsigma}$. Note that it is equal to $-\frac{\partial \Delta \pi^l(c)}{\partial c}$ evaluated at the point c^l_{PT}, which is precisely where the change in profits moves from positive to negative territory. It is therefore positive. The equivalent term for the NTB case substitutes $(\nu^h)^2$ in place of τ^h, but is still positive.

$\underline{\tau^l}$: First, we need a statement of how the proportion of supporters varies with τ^l.

$$\frac{\partial p^l_{PT}}{\partial \tau^l} = \frac{k}{c^l_A}\left(\frac{c^l_{PT}}{c^l_A}\right)^{k-1}\frac{\partial c^l_{PT}}{\partial \tau^l}.$$

If $\frac{\partial c^l_{PT}}{\partial \rho^l}$ is negative, as expected, than $\frac{\partial c^l_{PT}}{\partial \rho^l}$ will be as well. After differentiating the implicit solution for c^l_{PT}, given in Definition 2, and rearranging terms we get the following solution for the tariff case:

$$\frac{\partial c^l_{PT}}{\partial \tau^l} = \frac{\frac{L^h}{2\gamma}(\tau^h)(c^l_X - c^l_{PT})\frac{\partial c^l_X}{\partial \tau^l} + \frac{L^l}{2\gamma}(c^l_D - c^l_{PT})\frac{\partial c^l_D}{\partial \tau^l}}{\chi}.$$

In the short-term, $\frac{\partial c^l_X}{\partial \tau^l} = 0$ so we only need to check $\frac{\partial c^h_D}{\partial \tau^l}$. This is equal to

$$\frac{k(\tau^l)^{-k-1}\frac{\alpha - c^h_A}{(c^h_D)^{k+1}}}{\frac{1}{(c^h_D)^k + 1} + \frac{(k+1)(\alpha - c^h_D)}{(c^h_D)^{k+2}}}.$$

This is clearly positive, so the proportion of firms supporting a move to trade is increasing in home country tariffs. The same proof applies to the NTB case.

<u>τ^h</u>:

$$\frac{\partial p^l_{PT}}{\partial \tau^h} = \frac{k}{c^l_A}\left(\frac{c^l_{PT}}{c^l_A}\right)^{k-1}\frac{\partial c^l_{PT}}{\partial \tau^h}.$$

If $\frac{\partial c^l_{PT}}{\partial \tau^h}$ is positive, as expected, than $\frac{\partial p^l_{PT}}{\partial \tau^h}$ will be as well. After differentiating the implicit solution for c^l_{PT}, and noting that c^l_D is not a function of τ^h, we get the following solution:

$$\frac{\partial c^l_{PT}}{\partial \tau^h} = \frac{\frac{L^h}{2\gamma}(c^l_X - c^l_{PT})^2 + \frac{L^h}{2\gamma}(\tau^h)(c^l_X - c^l_{PT})\frac{\partial c^l_X}{\partial \tau^h}}{\chi}.$$

Note that the numerator here represents the change in profits resulting from an increase in τ^h for a firm with productivity $c = c^l_{PT}$. There are cross-cutting forces here because higher tariffs reduce competition in h but also raise a firm's price. However, we already showed in Appendix A6 that no firm benefits from an increase in tariffs, and this is a specific instance of that.

No such result exists for the NTB case, but we can state an intuitive requirement: the lowest productivity supporter of a trade agreement must not benefit from greater non-tariffs barriers in their export market. This seems like it should be easy to confirm, but the explicit solution of c^l_{PT} is too complex to employ. In any event, the condition held across 100% of the simulations described above.

m^l and f^l_E: To simplify, all derivatives are taken with respect to ϕ^l. Any function increasing in ϕ^l will also be increasing in m^l and f^l_E.

$$\frac{\partial p^l_{PT}}{\partial \phi^l} = k\left(\frac{c^l_{PT}}{c^l_A}\right)^{k-1}\left(\frac{1}{c^l_A}\frac{\partial c^l_{PT}}{\partial \phi^l} - \frac{c^l_{PT}}{(c^l_A)^2}\frac{\partial c^l_A}{\partial \phi^l}\right).$$

On inspection both $\frac{\partial c^l_A}{\partial \phi^l}$ and $\frac{\partial c^l_{PT}}{\partial \phi^l}$ are positive so the sign here is indeterminate. The following expression is a sufficient condition for $\frac{\partial p^l_{PT}}{\partial \phi^l}$ to be negative:

$$\frac{\partial c^l_{PT}}{\partial c^l_A}\frac{c^l_A}{c^l_{PT}} < 1.$$

Note that we made use of the fact that $\frac{\partial c^l_A}{\partial \phi^l} = \frac{1}{k+2}\frac{1}{\phi^l}c^l_A > 0$. This is the elasticity of c^l_{PT} with respect to c^l_A. If this elasticity is less than one than the proportion of supporters is decreasing in ϕ^l. Intuitively, if the comparative advantage of the country decreases, then the pro-trade cutoff should either increase, or at least not decrease too much. Examining across the grid, this condition held in every case.

m^h and f^h_E: All derivatives are taken with respect to ϕ^h.

$$\frac{\partial p^l_{PT}}{\partial \phi^l} = k\left(\frac{c^l_{PT}}{c^l_A}\right)^{k-1}\left(\frac{1}{c^l_A}\frac{\partial c^l_{PT}}{\partial \phi^h}\right).$$

So we can focus on $\frac{\partial c^l_{PT}}{\partial \phi^h}$ to determine the sign of $\frac{\partial p^l_{PT}}{\partial \phi^l}$.

$$\frac{\partial c^l_{PT}}{\partial \phi^h} = \frac{\frac{L^h}{2\gamma}(\tau^h)^2(c^l_X - c^l_{PT})\frac{\partial c^h_D}{\partial \phi^h} + \frac{L^l}{2\gamma}(c^l_D - c^l_{PT})\frac{\partial c^l_D}{\partial \phi^h}}{\chi}.$$

In the short term, $\frac{\partial c^l_D}{\partial \phi^h}$ and $\frac{\partial c^h_D}{\partial \phi^h}$ are both positive.

$\underline{L^l}$:

$$\frac{\partial p^l_{PT}}{\partial L^l} = k\left(\frac{c^l_{PT}}{c^l_A}\right)^{k-1}\left(\frac{1}{c^l_A}\frac{\partial c^l_{PT}}{\partial L^l} - \frac{c^l_{PT}}{(c^l_A)^2}\frac{\partial c^l_A}{\partial L^l}\right).$$

$\frac{\partial c^l_A}{\partial L^l} = -\frac{1}{L^l}\frac{c^l_A}{k+2}$ is negative. Upon examination, $\frac{\partial c^l_{PT}}{\partial L^l}$ also turns out to be negative, so we need to evaluate $\frac{\partial p^l_{PT}}{\partial L^l}$ itself at every point on the grid. To do so, we again differentiate the implicit solution for c^l_{PT} with respect to L^l and solve for $\frac{\partial c^l_{PT}}{\partial L^l}$. This is:

$$\frac{\frac{L^h}{2\gamma}\tau^h(c^l_X - c^l_{PT})\frac{\partial c^l_X}{\partial L^l} + \frac{1}{4\gamma}(c^l_D - c^l_{PT})^2 + \frac{L^l}{2\gamma}(c^l_D - c^l_{PT})\frac{\partial c^l_D}{\partial L^l} - \frac{1}{4\gamma}(c^l_A - c^l_{PT})^2 - \frac{L^l}{2\gamma}(c^l_A - c^l_{PT})\frac{\partial c^l_A}{\partial L^l}}{\chi}.$$

τ^h is replaced with $(\nu^h)^2$ for the NTB case. Note that $\frac{\partial c^l_X}{\partial L^l} = 0$ in the long-run case. In the short-run the sign of both $\frac{\partial p^l_{PT}}{\partial L^l}$ and $\frac{\partial c^l_D}{\partial L^l}$ are indeterminate, although generally positive as described in Numerical Simulation 1.

$\underline{L^h}$:

$$\frac{\partial p^l_{PT}}{\partial L^h} = k\left(\frac{c^l_{PT}}{c^l_A}\right)^{k-1}\frac{1}{c^l_A}\frac{\partial c^l_{PT}}{\partial L^l}.$$

Therefore, the sign of $\frac{\partial c^l_{PT}}{\partial L^h}$ determines the sign of $\frac{\partial p^l_{PT}}{\partial L^h}$.

$$\frac{\partial c^l_{PT}}{\partial L^h} = \frac{\frac{1}{4\gamma}\tau^h(c^l_X - c^l_{PT})^2 + \frac{L^h}{2\gamma}\tau^h(c^l_X - c^l_{PT})\frac{\partial c^l_X}{\partial L^h} + \frac{L^l}{2\gamma}(c^l_D - c^l_{PT})\frac{\partial c^l_D}{\partial L^h}}{\chi}.$$

τ^h is replaced with $(\nu^h)^2$ for the NTB case. Both $\frac{\partial p^l_{PT}}{\partial L^l}$ and $\frac{\partial c^l_{PT}}{\partial L^l}$ are indeterminate, although generally negative as described in Numerical Simulation 1.

B3: Proportion of Profits Comparative Statics

$$\begin{aligned}
p_{PT}^{\pi^l} &= \frac{1}{f_E}\int_0^{c_{PT}^l} \pi^l(c)\mathrm{d}G^l(c) \\
&= \frac{1}{f_E}\frac{L^l}{4\gamma}\int_0^{c_{PT}^l} ((c_A^l)^2 - 2c_A^l c + c^2)\left(\frac{c}{m^l}\right)^{k-1}\frac{k}{m^l}\mathrm{d}c \\
&= \frac{1}{f_E}\frac{L^l}{4\gamma}\frac{k}{(m^l)^k}\left((c_A^l)^2\frac{(c_{PT}^l)^k}{k} - 2c_A^l\frac{(c_{PT}^l)^{k+1}}{k+1} + \frac{(c_{PT}^l)^{k+2}}{k+2}\right)
\end{aligned}$$

Three pieces are worth exploring. First, some of the comparative statics involve parameters in the group $\frac{1}{f_E}\frac{L^l}{4\gamma}\frac{k}{(m^l)^k}$, so we define

$$\left((c_A^l)^2\frac{(c_{PT}^l)^k}{k} - 2c_A^l\frac{(c_{PT}^l)^{k+1}}{k+1} + \frac{(c_{PT}^l)^{k+2}}{k+2}\right) \equiv \chi_1.$$

The following sufficient condition must be positive for χ_1 to be positive:

$$\begin{aligned}
(c_A^l)^2(k^2+3k+2) - 2c_A^l c_{PT}^l(k^2+2k) + (c_{PT}^l)^2(k^2+k) &> \\
(c_A^l)^2(k^2+2k+2) - 2c_A^l c_{PT}^l(k^2+2k) + (c_{PT}^l)^2(k^2+2k) &> \\
(k^2+2k)(c_A^l - c_{PT}^l)^2 &> 0.
\end{aligned}$$

Each step uses the fact that $c_A^l > c_{PT}^l$.

Second, some of the parameters will affect c_A^l so we define

$$\left(2c_A^l\frac{(c_{PT}^l)^k}{k} - 2\frac{(c_{PT}^l)^{k+1}}{k+1}\right) \equiv \chi_2.$$

Again, χ_2 is positive because $c_A^l > c_{PT}^l$.

Third, all of the parameters will affect c_{PT}^l so we need the sign of

$$\left((c_A^l)^2(c_{PT}^l)^{k-1} - 2c_A^l(c_{PT}^l)^k + (c_{PT}^l)^{k+1}\right) \equiv \chi_3.$$

Factorization as above shows that χ_3 is positive. We can now examine each comparative static.

$\underline{\tau^l}$:

$$\frac{\partial p_{PT}^{\pi^l}}{\partial \tau^l} = \frac{1}{f_E}\frac{L^l}{4\gamma}\frac{k}{(m^l)^k}\chi_3\frac{\partial c_{PT}^l}{\partial \tau^l}$$

because $\frac{\partial c_A^l}{\partial \tau^l} = 0$. We showed in Appendix B2 that $\frac{\partial c_{PT}^l}{\partial \tau^l} > 0$, so $p_{PT}^{\pi^l}$ is increasing in τ^l.

$\underline{\tau^h}$:

$$\frac{\partial p_{PT}^{\pi^l}}{\partial \tau^h} = \frac{1}{f_E}\frac{L^l}{4\gamma}\frac{k}{(m^l)^k}\chi_3\frac{\partial c_{PT}^l}{\partial \tau^h}$$

because $\frac{\partial c_A^l}{\partial \tau^h} = 0$. We showed in Appendix B2 that $\frac{\partial c_{PT}^l}{\partial \tau^h} < 0$ in the tariff case (and generally will be in non-tariff barrier case), so $p_{PT}^{\pi^l}$ is decreasing in τ^h.

$\underline{m^l \text{ and } f_E^l}$:

$$\frac{\partial p_{PT}^{\pi^l}}{\partial m^l} = -\frac{1}{f_E}\frac{L^l}{4\gamma}\frac{k^2}{(m^l)^{k+1}}\chi_1 + \frac{1}{f_E}\frac{L^l}{4\gamma}\frac{k}{(m^l)^k}\left(\chi_2\frac{\partial c_D^l}{\partial m^l} + \chi_3\frac{\partial c_{PT}^l}{\partial m^l}\right).$$

This case is similar L^l in that the sign of $\frac{\partial p_{PT}^{\pi^l}}{\partial m^l}$ is indeterminate because the first term is negative, and the second term is positive because $\frac{\partial c_D^l}{\partial m^l}$ and $\frac{\partial c_{PT}^l}{\partial m^l}$ are both positive. At every evaluated point in the parameter space it was found that $\frac{\partial p_{PT}^{\pi^l}}{\partial m^l} < 0$.

$\underline{m^h \text{ and } f_E^h}$:

$$\frac{\partial p_{PT}^{\pi^l}}{\partial m^h} = \chi_3\frac{\partial c_{PT}^l}{\partial m^h}$$

because $\frac{\partial c_A^l}{\partial m^h}$ is zero. $\frac{\partial c_{PT}^l}{\partial m^h} > 0$ so $p_{PT}^{\pi^l}$ is increasing in m^h.

$\underline{L^l}$:

$$\frac{\partial p_{PT}^{\pi^l}}{\partial L^l} = \frac{1}{f_E}\frac{1}{4\gamma}\frac{k}{(m^l)^k}\chi_1 + \frac{1}{f_E}\frac{L^l}{4\gamma}\frac{k}{(m^l)^k}\left(\chi_2\frac{\partial c_D^l}{\partial L^l} + \chi_3\frac{\partial c_{PT}^l}{\partial L^l}\right).$$

The first term is positive and the second term is negative, because $\frac{\partial c_D^l}{\partial L^l}$ and $\frac{\partial c_{PT}^l}{\partial L^l}$ are both negative (see Appendix B2). Therefore, this entire expression must be evaluated at every point along the grid. Doing so reveals that in the long-run $\frac{\partial p_{PT}^{\pi^l}}{\partial L^l} > 0$. In the short-run, the sign of the change can be positive or negative, however in the numerical simulations conducted it was generally positive.

$\underline{L^h}$:

$$\frac{\partial p_{PT}^{\pi^l}}{\partial L^h} = \chi_3 \frac{\partial c_{PT}^l}{\partial L^h}$$

because $\frac{\partial c_A^l}{\partial L^h}$ is zero. In the long-run case, $\frac{\partial c_{PT}^l}{\partial L^h} < 0$ so $p_{PT}^{\pi^l}$ is decreasing in L^h. In the short run, the sign of $\frac{\partial c_{PT}^l}{\partial L^h}$ was indeterminate although generally negative across the grid of numerical simulations.

B4: Solving the Model when $k^l \neq k^h$

Before presenting the revised model, it will be demonstrated that for the long-run case, p_{PT}^l does not vary with γ when $k^l = k^h$. First, note that each of the long-run cutoffs c_A^l, c_D^l and c_X^l is homogeneous of degree $\frac{1}{k+2}$ in γ. Examining the explicit solution for the c_{PT}^l [omitted here] it is clear that c_{PT}^l is homogeneous of degree one in c_A^l, c_D^l and c_X^l and is only a function of γ via these cutoffs. It then follows that c_{PT}^l is homogeneous of degree $\frac{1}{k+2}$ in γ. Moreover, because $p_{PT}^l = \left(\frac{c_{PT}^l}{c_A^l}\right)^k$, p_{PT}^l is homogeneous of degree zero in γ.

For the proportion $p_{PT}^{\pi^l}$, note that

$$p_{PT}^{\pi^l} = \frac{1}{f_E}\frac{L^l}{4\gamma}\frac{k}{(m^l)^k}\left((c_A^l)^2\frac{(c_{PT}^l)^k}{k} - 2c_A^l\frac{(c_{PT}^l)^{k+1}}{k+1} + \frac{(c_{PT}^l)^{k+2}}{k+2}\right).$$

Using the results above, this function is also homogeneous of degree zero in γ.

To solve the model when $k^l \neq k^h$, we can start with the zero-profit entry conditions for the firms in each country post-liberalization, because the autarky case is easily solved analytically in the way described in Appendix A. Evaluating the integrals defined by $E[\pi(c)] - f_E = 0$ we get a system of two equations with two unknowns:

$$L^l (c_D^l)^{k^l+2} + L^h \tau^h \left(\frac{c_D^h}{\tau^h}\right)^{k^l+2} = 2\gamma(k^l+1)(k^l+2)(m^l)^{k^l} f_E$$

and

$$L^h (c_D^h)^{k^h+2} + L^l \tau^l \left(\frac{c_D^l}{\tau^l}\right)^{k^h+2} = 2\gamma(k^h+1)(k^h+2)(m^h)^{k^h} f_E.$$

Because $k^l \neq k^h$, there is generally no analytic solution for the cutoffs, and so these must be solved numerically. We continue to assume that Assumption 1 holds in order to ensure that both countries have a differentiated product sector post-liberalization.[32]

Solving for the number of firms with trade also requires numerical evaluation, but we first need to build up a set of equations from more primitive quantities. I will concentrate on solving for the number of entrants in each country, N_E. The average price of a variety produced by l's firms and sold domestically is $\bar{p}_D^l = \frac{c_D^l(2k^l+1)}{2k^l+1}$, while the average price of a variety exported by l's firms is $\bar{p}_X^l = \frac{c_X^l(2k^l+1)\tau^h}{2k^l+1}$. The average prices for h's varieties are defined analagously. The number of firms serving the market in l is $N^l = \left(\frac{c_D^l}{m^l}\right)^{k^l} N_E^l + \left(\frac{c_X^h}{m^h}\right)^{k^h} N_E^h$. N^h is defined similarly. The average

[32] Note that for NTBs, the above equations have a squared NTB value in front of each of the second terms. The rest of the equations (which are all in terms of consumers' demand functions) are the same except they replace τ's with ν's.

price of all varieties, foreign and domestic, sold in l is then

$$\bar{p}^l = \frac{\bar{p}^l_D \left(\frac{c^l_D}{m^l}\right)^{k^l} N^l_E}{N^l} + \frac{\bar{p}^h_X \left(\frac{c^h_X}{m^h}\right)^{k^h} N^h_E}{N^l},$$

and similarly for h. Finally, we use the zero-demand or 'choke price' equations for each country to determine the number of entrants. These equations are

$$\frac{1}{\eta N^l + \gamma}\left(\gamma\alpha + \eta N^l \bar{p}^l\right) = c^l_D$$

and

$$\frac{1}{\eta N^h + \gamma}\left(\gamma\alpha + \eta N^h \bar{p}^h\right) = c^h_D.$$

Note that these final two equations are all in terms of parameters, cutoffs (which we have solved) and N^l_E and N^h_E which our the two unknowns.

B5: Changes in product differentiation

Let's first assume that $k^l > k^h$. We then expect to find that the percentage of supporters of a liberalization in l will increase as γ increases. This derivative is

$$\frac{\partial p^l_{PT}}{\partial \gamma} = k^l \left(\frac{c^l_{PT}}{c^l_A}\right)^{k^l-1} \left(\frac{1}{c^l_A}\frac{\partial c^l_{PT}}{\partial \gamma} - \frac{c^l_{PT}}{(c^l_A)^2}\frac{\partial c^l_A}{\partial \gamma}\right).$$

This will be positive if

$$\frac{\frac{\partial c^l_{PT}}{\partial \gamma}}{c^l_{PT}} > \frac{\frac{\partial c^l_A}{\partial \gamma}}{c^l_A}.$$

In other words, this will be positive if the instantaneous percentage increase in c^l_{PT} is greater than the instantaneous percentage increase in c^l_A when γ increases. The latter is immediately available from results we have previously shown:

$$\frac{\frac{\partial c^l_A}{\partial \gamma}}{c^l_A} = \frac{1}{\gamma}\frac{1}{k^l+2}.$$

We therefore need to examine $\frac{\partial c^l_{PT}}{\partial \gamma}/c^l_{PT}$.

To do so, let's first examine the percentage change in c^l_{PT} induced by a change in c^l_A, c^l_D and c^l_X. Let's define p^l_A, p^l_D and p^l_X as the instantaneous percentage change in each of the cutoffs c^l_A, c^l_D and c^l_X induced by an increase in γ. Note also that $p^l_X = p^h_D$ because $c^l_X \propto c^h_D$.

Now let's examine the explicit form for c^l_{PT}. Using the quadratic formula, this is:

$$L^h c^l_X + L^l c^l_D - L^l c^l_A - \sqrt{\left(-L^h c^l_X - L^l c^l_D + L^l c^l_A\right)^2 + L^h \left(-L^h \left(c^l_X\right)^2 - L^l \left(c^l_D\right)^2 + L^l \left(c^l_A\right)^2\right)}.$$

A change in γ induces the following value of c^l_{PT}:

$$\begin{aligned}
= \quad & L^h c^l_X(1+p^l_X) + L^l c^l_D(1+p^l_D) - L^l c^l_A(1+p^l_A) \\
& -\Big(\left(-L^h c^l_X(1+p^l_X) - L^l c^l_D(1+p^l_D) + L^l c^l_A(1+p^l_A)\right)^2 \\
& + \; L^h \left(-L^h \left(c^l_X(1+p^l_X)\right)^2 - L^l \left(c^l_D(1+p^l_D)\right)^2 + L^l \left(c^l_A(1+p^l_A)\right)^2\right) \Big)^{\frac{1}{2}} \\
= \quad & (1+p^l_A)\Bigg((L^h c^l_X \frac{1+p^l_X}{1+p^l_A} + L^l c^l_D \frac{1+p^l_D}{1+p^l_A} - L^l c^l_A \\
& -\Bigg(\left(-L^h c^l_X \frac{1+p^l_X}{1+p^l_A} - L^l c^l_D \frac{1+p^l_D}{1+p^l_A} + L^l c^l_A\right)^2 \\
& + L^h \left(-L^h \left(c^l_X \frac{1+p^l_X}{1+p^l_A}\right)^2 - L^l \left(c^l_D \frac{1+p^l_D}{1+p^l_A}\right)^2 + L^l \left(c^l_A\right)^2\right) \Bigg)^{\frac{1}{2}} \Bigg) \\
\lesseqgtr \quad & (1+p^l_A) c^l_{PT}
\end{aligned}$$

The question, then, is under what circumstances will the percentage increase in c^l_{PT} be greater than the percentage increase in c^l_A. This will recreate the claimed pattern that the proportion of firms supporting trade is increasing in love-of-variety in the high k country.

Two conditions will suffice for this to be so:

1. $L^h c_X^l \frac{1+p_X^l}{1+p_A^l} + L^l c_D^l \frac{1+p_D^l}{1+p_A^l} > L^h c_X^l + L^l c_D^l$.

2. $L^h \left(c_X^l \frac{1+p_X^l}{1+p_A^l}\right)^2 + L^l \left(c_D^l \frac{1+p_D^l}{1+p_A^l}\right)^2 > L^h \left(c_X^l\right)^2 + L^l \left(c_D^l\right)^2$.

We now have to order p_A^l, p_D^l and $p_X^l = p_D^h$. Recall first that

$$p_A^l = \frac{1}{\gamma}\frac{1}{k^l+2}.$$

We will examine the percentage chance in p_D^l and show that it is less than p_A^l. To do so we need an expression for $\frac{\partial c_D^l}{\partial \gamma}$. Using the free entry conditions from Appendix B4 and the implicit function theorem, this is

$$\frac{\partial c_D^l}{\partial \gamma} = \frac{\phi^l - \sigma^h (c_D^h)^{k^l-k^h} \frac{k^l+2}{k^h+2}\phi^h}{L^l (c_D^l)^{k^l+1}(k^l+2) - L^l \sigma^l \sigma^h (c_D^h)^{k^l-k^h}(c_D^l)^{k^h+1}}.$$

We can now start to manipulate the instantaneous percentage change in c_D^l and show that it is less than $\frac{1}{\gamma}\frac{1}{k^l+2}$.

$$\begin{aligned}
p_D^l &= \frac{\phi^l - \sigma^h (c_D^h)^{k^l-k^h} \frac{k^l+2}{k^h+2}\phi^h}{L^l (c_D^l)^{k^l+2}(k^l+2) - L^l \sigma^l \sigma^h (c_D^h)^{k^l-k^h}(c_D^l)^{k^h+2}(k^l+2)} \\
&= \frac{1}{\gamma}\frac{1}{k^l+2}\frac{\phi^l - \sigma^h (c_D^h)^{k^l-k^h} \frac{k^l+2}{k^h+2}\phi^h}{\frac{1}{\gamma} L^l (c_D^l)^{k^l+2} - \frac{1}{\gamma} L^l \sigma^l \sigma^h (c_D^h)^{k^l-k^h}(c_D^l)^{k^h+2}} \\
&= \frac{1}{\gamma}\frac{1}{k^l+2}\frac{\phi^l - \sigma^h (c_D^h)^{k^l-k^h} \frac{k^l+2}{k^h+2}\phi^h}{\phi^l - \frac{1}{\gamma} L^h \sigma^h (c_D^h)^{k^l+2} - \frac{1}{\gamma} L^l \sigma^l \sigma^h (c_D^h)^{k^l-k^h}(c_D^l)^{k^h+2}}
\end{aligned}$$

The third line above follows from plugging in the definition of c_D^l in terms of c_D^h, which comes from the zero-profit entry condition.

Now, in order to show that $p_D^l < p_A^l$, we only need to show that

$$\sigma^h (c_D^h)^{k^l-k^h} \frac{k^l+2}{k^h+2}\phi^h > \frac{1}{\gamma} L^h \sigma^h (c_D^h)^{k^l+2} + \frac{1}{\gamma} L^l \sigma^l \sigma^h (c_D^h)^{k^l-k^h}(c_D^l)^{k^h+2}.$$

This condition is equivalent to:

$$\frac{k^l+2}{k^h+2}\phi^h\gamma > L^h(c_D^h)^{k^h+2} + L^l\sigma^l(c_D^l)^{k^h+2}$$

which in turn implies

$$\left(\frac{\frac{k^l+2}{k^h+2}\phi^h\gamma - L^l\sigma^l(c_D^l)^{k^h+2}}{L^h}\right)^{\frac{1}{k^h+2}} > c_D^h.$$

Looking at the free entry condition for country l, this is confirmed.

Note that using the same argument, it is possible to show that $p_D^h > p_A^h$. We now have a complete ordering of all of the percentage changes:

$$p_D^l < p_A^l < p_A^h < p_D^h = p_X^l.$$

This gives us the result in Comparative Static 4.

Now consider our two conditions from above. For example, condition 1 was that

$$L^h c_X^l \frac{1+p_X^l}{1+p_A^l} + L^l c_D^l \frac{1+p_D^l}{1+p_A^l} > L^h c_X^l + L^l c_D^l.$$

With the ordering above it is likely that this condition will hold (because $p_X^l >> p_A^l$ and $p_D^l < p_A^l$) but not guaranteed. Indeed, at extreme values in the parameter space it is possible to find points where this does not hold, so we consider numerical simulations again.

Numerical Simulation 2 is checked for the long-term only on the grid below. To save on dimensions, k^h was set to 3, which is close to the value 3.4 used in simulation in Bernard, Redding and Schott (2008). I use a relatively large number of points for γ to ensure that the extreme ends of its values are thoroughly explored. k^l varies relatively little because even moderate differences in k between countries tend to result in no entry in the high-k country.

Parameter	Range	Grid Points
L^l	$[800, 2000]$	3
L^h	$[800, 2000]$	3
m^l	$[2, 4]$	3
m^h	$[2, 4]$	3
τ^l	$[1.2, 3]$	3
τ^h	$[1.2, 3]$	3
k^l	$[3.01, 3.2]$	3
γ	$[.001, .999]$	8

At every point across the grid, it was found that the conjectured pattern held. A justification is provided for these ranges of values above at the beginning of Appendix B.

Chapter 3

Divided Industries in the Fight for Free Trade Agreements

Introduction

This chapter further develops and tests the theory of intra-industry disagreements over trade liberalization. Following the literature on firm heterogeneity in export performance, it is argued that only exporting firms will benefit from – and therefore support – trade liberalization. In industries featuring significant intra-industry trade, non-exporters will oppose trade liberalization because it means only greater competition from abroad. Two industry features closely connected to the extent of intra-industry trade are particularly crucial as necessary conditions for these divisions: neither country can be overwhelmingly competitive and the product should be differentiated. This basic logic is then extended to situations where non-exporting firms differ in the extent to which they supply inputs to exporting firms.

Several alternative explanations for these divisions are also considered in detail, including multinationalization and variation in sourcing inputs from abroad.

This theory is then tested by examining the response of US industries to the Korea-US Free Trade Agreement and the Australia-US Free Trade Agreement. Data on the publicly expressed attitudes of both trade associations and firms towards these agreements are used to identify industries as supporting, opposing or divided over these agreements. The analysis suggests a very close link between the extent of product differentiation and the existence of intra-industry divisions over trade. These divisions are especially pronounced in US industries that are as competitive or somewhat less competitive than their foreign competition. It is also shown that support for the FTAs in both countries in the same narrowly-defined industry are more likely where the product is differentiated and comparative (dis)advantage muted. Alternative explanations of intra-industry differences, such as variation in the extent of foreign production and sourcing of inputs, are certainly operative but do not appear to invalidate the basic theory which is rooted in heterogeneity in firm export performance.

All of the theoretical results on firm-level preferences in the paper were derived chapter two which relied on a model of firms and trade developed in Melitz and Ottaviano (2008). This same model is used here to derive a measure of the relative costs of the US and its two trade partners. This model-based measure of comparative advantage recovers underlying differences in costs of production using observables.

The trade politics literature has long debated whether factoral or industrial divisions are most salient in trade politics. This paper empirically examines a third possibility – that industries might be internally divided over trade liberalization – proposed in the literature on firm heterogeneity in export performance (Melitz, 2003). Three empirical patterns documented here are inconsistent with either the Stolper-Samuelson or Ricardo-Viner approaches to trade, or both. Single industries feature both support and opposition to bilateral trade liberalization. A broad range of industries feature support for trade liberalization in both trade partners. Finally, many industries at a clear comparative disadvantage relative to foreign producers nonetheless feature supporters of trade liberalization.

This line of research also extends the emerging literature on the politics of firms and trade by specifying conditions under which intra-industry reallocations of production are likely to lead to intra-industry divisions over trade liberalization (Melitz, 2003; Milner, 1988*b*). While often ignored, the complex webs of interests *within* industries have been a topic of considerable interest in the trade politics literature from its inception (Schattschneider, 1935). By focusing on the role of firm heterogeneity in industries which are both import- and export-competing, it makes an empirical case for expanding the set of circumstances under which industries are predicted to be divided over trade. This work also adds to subsequent empirical and theoretical work on firms and trade, by examining theoretically cases where trade policy remains a public good to the industry (Bombardini, 2008; Gilligan, 1997).

The paper also expands theoretically on the role of two existing explanations for intra-industry divisions over trade. The first of these is within-industry variation in the extent of multinational production (Milner, 1988*a*). It is argued here that foreign direct investment of the vertical type is a likelier cause of intra-industry disagreement than horizontal FDI. However, the circumstances most conducive to vertical FDI (sharp factor price differences, proprietary production technologies) are not the same as the characteristics emphasized in the new, new trade theory (similar levels of competitiveness, differentiation in *final* goods). These two explanations are therefore empirically implicated under different circumstances. The trade literature has also examined variation in reliance on foreign inputs within industries as an explanation for internal disagreements over trade liberalization. This logic is refined here by emphasizing the importance of *differentiated* inputs as a precondition for excluding some firms from the benefits of increased competition.

All of these arguments are tested on an original dataset of association, firm and industry attitudes towards trade agreements between the US and the Republic of Korea and Australia. The data document an extensive set of industries which failed to convey a united front on the agreement, and also demonstrates that many narrowly-defined industries had supporters of the agreements in both countries agreeing to reduce trade barriers. The data also suggest that these agreements had support from the vast majority of industries, while a number of industries adopted no position and relatively few were united in opposition.

Very strong effects of product differentiation on intra-industry divisions (and support in both industries) are documented. Moreover, the impact of product differentiation on these outcomes are generally much stronger when differences in competitiveness are muted, as the theory predicts. In general, the paper also finds good evidence for the role of differentiated inputs in generating intra-industry division and more inconsistent support for the role of FDI. Moreover, the substantive impact of these factors is far smaller than that of product differentiation and comparative advantage, the factors emphasized in this 'new, new trade' approach to industry attitudes.

The idea that firms within an industry might disagree over trade liberalization is not new, but the evidence here suggests that variation in firm performance in exporting, under the right conditions, is a suitable addition to the list of reasons why. One interesting implication of this focus on intra-industry divisions is that in many industries there will be supporters of the agreed reductions in trade barriers in both countries. When the agreement's terms are negotiated, industries at home share a common interest which is directly opposed to that of their competitors abroad. This is to reduce trade barriers as much as possible in the foreign market and maintain them in the home market. Once the agreement's terms are set, however, industries are fractured between exporting- and non-exporting firms even as new coincidences of interests arise internationally. The most productive firms *in both countries* wish to see the trade agreement pass into law; the least productive firms wish to see it defeated. When products are differentiated, bilateral trade liberalization divides industries.

Theory and Observable Implications

This section explains the logic behind the comparative statics connecting comparative advantage, product differentiation and intra-industry disagreements over trade. Unless otherwise stated, all results build off of a separate dissertation paper which uses the Melitz and Ottaviano (2008) model of trade with heterogeneous firms to explore the question of intra-industry divisions over trade. This logic is then extended informally to the case of upstream industries supplying differentiated products to downstream industries. Finally, several alternative explanations for intra-industry disagreement on trade are discussed, including the role of foreign direct investment and reliance on imported inputs.

Differentiated Products and Divided Industries

The possibility of intra-industry redistribution among firms in the wake of trade liberalization relies on four crucial factors and several subsidiary assumptions. Most obviously, divisions within an industry over trade liberalization require that firms differ in export engagement. These differences in ability to export are now well-established empirically and generally appear to be ubiquitous across industries (Bernard and Jensen, 2004; Bernard et al., 2003; Tybout, 2003; Mayer and Ottaviano, 2008). Variation in engagement in export markets is usually explained by exogenous (and intra-industry) differences in total factor productivity. More productive firms can charge lower prices or produce better quality goods and therefore have the greatest sales and profits. Only the most productive firms can therefore absorb the large fixed costs associated with entering a new export market, or find positive demand for their varieties abroad when barrier to trade are factored into prices.

The second crucial factor is that the product be differentiated. The extent of product differentiation, which varies across industries, is usually treated as a consequence of a taste for variety among consumers. For example, a single consumer may spread his consumption across multiple labels of wine or brands of clothing. Or, consumers may differ in their tastes, leading to differentiation in aggregate consumption, as with toothpaste and cars. Similarly, businesses consuming intermediate inputs may depend on inputs narrowly tailored to their enterprise or benefit from a variety of available specifications, as with machine tools and other industrial machinery.

Product differentiation plays an important role in generating intra-industry divisions over trade liberalization for several reasons. Most importantly, it gives rise to intra-industry trade, where countries both import and export goods in the same product class. Intra-industry trade means that bilateral trade liberalization has two competing effects: it leads to greater competition in the home market while increasing opportunities for export. Combined with firm heterogeneity, these dual effects mean that the least productive firms face only costs from greater trade while the most productive can gain on net due to increased sales in the foreign market.[1]

[1] In the dominant model of trade with heterogeneous firms and differentiated products, which make use of the constant elasticity of substitution demand system, this simple story about competition in product markets does not apply. Because of certain properties of demand with the CES utility function, reallocations of sales from lower- to higher-productivity firms is driven entirely by competition in factor markets rather than goods markets (Melitz, 2003). Under these circumstances, could an industry with heterogeneous firms but a homogeneous product be divided over trade? There are a complex set of forces here, but my conjecture is that absent economies of scale or differences among firms in factor intensity this is unlikely. Note first that homogeneous goods have a single price and are indistinguishable to consumers. It is clear that in the absence of fixed costs of exporting (or some artificial barrier which discriminates between firms) all will benefit

The coarse distinction between homogeneous and differentiated product industries can be refined. The 'extent' of intra-industry divisions over trade is generally increasing in a continuous love-of-variety parameter in the model of trade with heterogeneous firms which underwrites the results in this paper. Put more precisely, the proportion of firms which support trade liberalization in a comparative disadvantage industry is increasing in consumer love-of-variety. The proportion of firms which *oppose* trade liberalization is also generally increasing in consumer love-of-variety in comparative advantage industries. The logic behind this is very similar to that described above. Greater product differentiation opens up new export opportunities for the less efficient firms in countries at a comparative disadvantage in the differentiated good. At the same time, this leads to more competition in the home market of the country at a comparative advantage, pushing more producers to oppose trade liberalization.

The third crucial condition for intra-industry divisions over trade is that neither country be overwhelmingly competitive in the production of the differentiated product. If that is the case then no firms will support liberalization in the country at a strong comparative disadvantage and all (or nearly all) firms will support liberalization in the country at a comparative advantage in the particular product. In

from an increase in the domestic price of the good, whether they export or not. If some discriminatory trade barrier exists, those with privileged access can only produce so much for the foreign market because of diseconomies of scale. This leaves an arbitrage opportunity for that firm, wherein they supplement their production with domestic purchases to sell abroad. This then pushes up the domestic price of the good, rewarding even those firms who are incapable of exporting.

the model used to derive these results, comparative advantage is driven by technology differences and market size (countries with a bigger market will have greater entry, and so more productive firms, on average). Here I assume that the market sizes between the countries are equivalent across all industries and focus only on technology differences, treated here as *ex ante* average costs of production for firms.

The final ingredient for intra-industry divisions over trade liberalization is that both countries reduce barriers to trade in the industry. Unilateral liberalization, at least in the short run, only increases competition in the home market while providing no new opportunities in the export market. This is straightforward theoretically, but will require careful attention in the empirical section because in trade agreements there generally are some industries which avoid any substantive liberalization.

There are two subsidiary conditions for intra-industry disagreements which are important to mention because they have been important areas of debate in the trade politics literature. First, it is assumed here that capital assets are firm-specific, at least in the short run. This ensures that owners will evaluate the impact of trade liberalization by considering the fortunes of their own business, not their industry or those of capital owners more generally. Second, it is assumed in developing this theory that trade policy is a public good to firms in the industry. In the model on which the preceding results are based, firms are neither able to lobby for, nor desirious of, variety-specific protection. This is because all goods in an industry are to some extent substitutable and varieties are global monopolies. Of course, this may not be the case in practice and is discussed further in the section on alternative explanations.

Before moving to the next section, it is important to provide some greater precision about the meaning of comparative advantage as used here. Three facts are crucial. In models with heterogeneous firms, comparative advantage must be defined by analogy, considering *average* prices in autarky. The Melitz and Ottaviano (2008) model is a partial equilibrium framework with a numeraire good which is traded, so a country has a 'comparative advantage' in a particular differentiated product if the average price of that product is lower in autarky then in the foreign economy. Finally, cross-country differences in comparative advantage in this model are affected only by market size and the cost distribution of firms entering the market, the latter of which is a form of Ricardian comparative advantage. Industries in larger markets with lower cost distributions have a comparative advantage, but only the cost distribution is assumed to vary across countries. Therefore, for the rest of the discussion I refer to the country with lower costs as having a comparative advantage or as being 'more competitive' in the production of the differentiated good.

Testable predictions

For the rest of the paper, the first and the fourth conditions (firm heterogeneity and mutual reductions in trade barriers) are generally taken as given, so the focus will be on product differentiation and comparative advantage as key explanatory factors. As noted above, firm heterogeneity in export performance has generally been found to be ubiquitous. In the FTAs examined, there are a few industries where little or no tariff reductions were made. A strategy for dealing with this is presented when the data is introduced. The theory described above therefore leads to a first set of testable predictions.

> **Prediction 1** Industries producing differentiated products are more likely to have both supporters and opponents of bilateral liberalization. In particular, intra-industry divisions are predicted in industries where neither trade partner is overwhelmingly competitive.

This hypothesis is testable using data on industry attitudes towards some proposed liberalization in a single country but of course the theory makes predictions about both trade partners. A separate but related empirical issue is that *opposition* to trade liberalization can be hard to observe, especially in industries which have supporters of trade. Smaller firms – the predicted losers from trade liberalization – are probably less likely to have fully formed opinions, have less resources to make their voices heard if they do, and may be cowed by the pro-trade orientation of the most powerful actors in the economy and government. Similarly, trade associations are likely to be most influenced by their largest members who may set the agenda on public policy issues.

In order to get around these limitations in the data, while taking advantage of industry positions in both trade partners, where available, I test the following prediction:

> **Prediction 2** Industries producing differentiated products are more likely to have supporters of trade liberalization in both countries. This should be especially likely in industries where neither trade partner is overwhelmingly competitive.

The question here is whether it is possible for both country's firms to support trade liberalization if the firms are not heterogeneous. If so, then Prediction 2 would perhaps provide evidence for new trade theory, which focuses on intra-industry trade with homogeneous firms, but not new, new trade theory as a model of trade politics. In future research, there is a need to model whether it is possible for homogeneous firms to benefit in both countries if products are differentiated. The answer likely depends on consumer behavior, but I consider this possibility implausible and assume throughout that support in both countries is evidence of firm heterogeneity.

A final empirical implication of the theory, which again acknowledges that support is generally easier to observe than opposition, relies on the fact that even comparative disadvantage industries might have supporters of trade liberalization as long as the product is differentiated.

> **Prediction 3** Industries at a comparative disadvantage are more likely to feature supporters of a proposed trade liberalization if the product is differentiated. This effect should also be present, if attenuated, in industries at a similar level of competitiveness relative to their foreign counterparts.

Extending the theory to suppliers of intermediate inputs

Some industries may not be directly engaged with export markets, but nonetheless may benefit (or be harmed) by trade liberalization because some downstream industry in their home market is affected by trade. For example, some US producers of stamped steel products came out in favor of the Korea-US Free Trade Agreement only after the agreement was renegotiated to facilitate greater auto exports to South Korea. Similarly, owners of cattle ranches are unlikely to export themselves, but can benefit from trade liberalization if processed meat exports result. Of course, both of these industries can simultaneously face both direct (in their own industry) or indirect (in the downstream industry) competition as a result of trade liberalization.

This suggests that industries might be divided 'by proxy'. If only some downstream firms are capable of profitably exporting, than perhaps only some of their suppliers will support greater trade liberalization. This of course raises the question of whether the same predictors described above – product differentiation, firm heterogeneity and moderate comparative (dis)advantage – are analytically useful. Considering each of these factors in turn, it is clear that the same industry features which predict intra-industry divisions should also predict intra-industry divisions 'by proxy', albeit with weaker explanatory power.

The extent of product differentiation is important in the sourcing industry as a straightforward extension of the logic described above. Homogeneous goods have a single market and a single price domestically, and so whether a homogeneous input ends up being manufactured into an export or not is immaterial. For example, feed corn sells at a single price whether or not the beef is subsequently exported. Differentiated inputs, on the other hand, are more likely to match specific suppliers with specific firms in long-term arrangements. These links lead to a mutual interest in the health of both supplier and supplied.

Firm heterogeneity, which in this setting means that only certain firms are presently (capable of) producing inputs for exporting firms, is somewhat trickier to address. It may be the case that the largest, most productive firms are most likely to source inputs from only the largest and most productive suppliers. This could reflect complementarities of scale between the levels of production as well as the superior ability of productive firms to search out the most effective suppliers. It could also be that there is simply variation in the extent of engagement with export-competing firms which differs among suppliers, which is especially believable in the short-run. In either case, trade liberalization will have distributive consequences within a single upstream industry.

What role would the comparative advantage of the supplying industry play? The competitiveness of the supplying industry contributes to the competitiveness of the downstream industry. Downstream industries which are sharply more (or less) competitive than their foreign competitors are less likely to be internally divided over trade liberalization. Upstream industries which are similarly 'moderate' in their productivity relative to foreign competitors should therefore be more likely to be divided over trade if their neutral comparative advantage contributes to the neutral comparative advantage of their downstream partners. Of course, many other factors contribute to the competitiveness of the downstream industry so observed correlations are expected to be somewhat weak.

Alternative Explanations for Divisions

There are several alternative explanations for intra-industry divisions over trade liberalization. In the seminal study of trade politics in America, Schattschneider (1935) describes many instances of apparent intra-industry disagreement in the fight over the Smoot-Hawley tariff bill and explained them with reference to multi-nationalization; variation in the reliance on sources of inputs from abroad; firm-specific ('private') protection; and industries being erroneously conflated. Each of these is discussed in turn.

Multinationals and foreign production Industries with both domestic- and foreign-based production are likely to feature divergent interests over trade liberalization. Those firms producing only in the domestic market may support or oppose further liberalization for the reasons described above. Firms producing abroad, on the other hand, are likely to share the interests of their foreign competitors and oppose further liberalization of the foreign market and favor liberalization of their home base, depending on their export participation. Distinguishing between these 'horizontal' and 'vertical' forms of foreign direct investment helps to ground expectations about when multinational engagement should predict intra-industry divisions.

Horizontal foreign direct investment occurs when foreign affiliates are founded or purchased primarily to serve the foreign markets in which production takes place. It is closely linked to firm- (rather than plant-)level economies of scale; modest differences in factor prices and productivity; and, high costs of trade due to either shipping costs or existing trade barriers (Brainard, 1997; Markusen and Venables, 2000). Caves (2000), in particular, highlights the links between proprietary technology, variation in firm competitiveness and product differentiation as explanations for horizontal FDI, while Helpman, Melitz and Yeaple (2004) argue that heterogeneity in productivity is also associated with horizontal FDI. These conditions for horizontal FDI (heterogeneous firms; product differentiation; no significant differences in factor prices) are very similar to those which predict intra-industry divisions over trade based on export performance.[2]

[2] One ambiguity here concerns the extent to which product differentiation is linked to horizontal

Are intra-industry divisions therefore likely when only some firms participate in horizontal FDI? Considering competition in the domestic market and the foreign market, in turn, suggest that the answer is no. By definition, firms engaging in horizontal FDI are not exporting back to their home market, so there is no additional competition in the home market caused by this form of FDI. However, it is possible that domestic-based firms which export may have a clash of interests with multinationals because the former wish to gain access to the foreign market, and the latter to restrict it. These clashes require a relatively implausible set of conditions whereby some firms are productive enough to export but insufficiently productive to invest abroad, while other firms are highly productive and motivated to invest abroad as the most efficient way access to the foreign market. For example, horizontal FDI is closely associated with large shipping costs which suggest few opportunities for exporting among the less productive potential exporters in the home market.

Vertical FDI, on the other hand, is a more promising site for intra-industry clashes precisely because the foreign production is aimed directly at export back to the home market. This sets up a complex clash of interests between multinationals, home-based exporters and firms which serve the domestic market only. The economic literature on vertical FDI has focused on locational advantages associated with foreign production, most prominently due to differences in factor endowments between countries, as well as transactions costs associated with outsourcing

FDI. On one hand, proprietary methods of production and R&D expenditures are not necessarily available only to differentiated final products. On the other hand, brand names and other "special skills in styling or promoting products" are likely to be closely linked to the extent of product differentiation (Caves, 2000, pp. 147).

of differentiated (i.e. firm-specifc) inputs (Helpman, 1984; Grossman and Helpman, 2002; Antras, 2003). Note however that the industries likely to feature these divisions are not the same as those where divisions arise because of heterogeneity in export performance. Vertical FDI is driven by sharp differences in factor prices while the theory outlined above says that these differences should create unity in industries. The links between product differentiation in *final* goods and vertical FDI are also not clear.

In the cases described below, both types of FDI at least partly explain certain instances of intra-industry disagreement over the FTAs examined. For example, it was commonly argued that the American Apparel and Footwear Association supported the Korea-US FTA in part because certain of its members were multinationals with production in South Korea who exported back to the US. At the same time, certain domestic-based producers of apparel opposed the agreement (most prominently producers of hosiery). Similarly, GM was the only one of the big three to initially support KORUS, and this was in part explained as a consequence of its subsidiary GM Korea Company's interests, which mostly consisted of sales in the Korean market. Once the agreement was amended to facilitate greater sales of US autos in Korea, each of the big three supported KORUS.

Still, multinationalization is not likely to explain the intra-industry divisions across the cases explored in this paper. First, many of the industries featuring divisions, like machine tools and seafood products, have little MNC production in South Korea by US firms. Second, total US FDI in South Korea is extremely modest in terms of the number of firms involved and so does not provide a very good explanation for entire associations (which feature anywhere from a dozen to several hundred members) and sets of firms supporting the agreement, despite the opposition of other firms in the industry. Third, the patterns of divisions predicted by this theory (that they occur in industries with relatively even competitiveness and producing differentiated products) do not predict vertical FDI while horizontal FDI does not seem like a promising site for divisions to occur. In the empirical section, I also suggest a regression-based approach for dealing with multinationalization as an alternative explanation.

Imported inputs Another explanation for intra-industry divisions over trade liberalization relies on the presumption that only some firms are capable of importing inputs from abroad. For example, South Korea is a quite competitive producer of basic chemicals and ferrous metals but it may be that only the largest downstream firms are capable of benefiting from this fact because of costs associated with sourcing inputs from abroad. Intra-industry variation in the extent of reliance on foreign inputs is not well-documented empirically, but is both plausible and a central piece of the theoretical literature (Antras and Helpman, 2004).

Product differentiation again plays a crucial role. If the imported input is undifferentiated, then all firms in the industry seemingly will benefit from liberalization of that industry because it lowers the domestic market price of that commodity. If, however, the product is differentiated, greater imports from abroad might benefit the firms getting access to new (and perfectly suited) varieties of inputs to the disfavor of other domestic producers.

In order to test this idea (and consider variation across industries in the extent of input importing-ness as an explanation for intra-industry divisions over trade liberalization) I again propose a regression adjustment based on some measures of reliance on imported inputs which are described in the next section. I also make the following prediction:

> **Prediction 4** Industries which source inputs the most from abroad are more likely to be divided over trade liberalization. This is particularly so if the inputs are differentiated.

Regarding the horse race between variation in exporting and variation in input importing as explanations for divisions, it is worth noting that there is no clear relationship *in theory* between reliance on foreign inputs, comparative advantage and the extent of product differentiation in the industry in question.

Conflating different industries and level of aggregation This explanation for divisions within industries can take two forms. First, different stages in the production process might be erroneously grouped together into a single final product industry. For example, producers of some input might oppose trade liberalization while users of the input would favor trade liberalization. Second, industry categories may be too coarse and mix together fundamentally different products which are not substitutes for one another and for which producers vary in competitiveness. In order to address these concerns, the empirical section uses six-digit NAICS industries, which is a relatively fine-grained level of aggregation. Final goods are unlikely to be mixed with intermediate inputs at this level, and this level of aggregation seems acceptable for attributing differences in export performance to firm-specific rather than technological or factoral explanations.

'Private' or firm-specific protection One of the core assumptions of the model on which the results here are presented is that trade protection in a given industry is a public good. There is a single domestic tariff or NTB which benefits all firms without exclusion and its benefits are not rivalrous at least above and beyond the usual competition among firms. This concern is clearly connected to the extent of product differentiation because it is harder to craft private protection for undifferentiated commodities. Moreover, there are examples in the agreements examined here which suggest firm- or industry-segment targeted protection, for example, the exclusion of 17 US rubber footwear categories from any tariff reductions which secured the support of that segment of the footwear industry. Two counter-arguments are worth making. First, there are many examples of divided industries where trade barriers were broadly reduced and evidence of 'carveouts' is limited. Second, these exemptions generally seem aimed at creating unity, rather than divisions. For example, leather and some footware producers would have supported KORUS without the special exceptions for some rubber footwear producers because their products were not exempted from tariff reductions in any event. These exceptions are addressed again in the following section.

Other policy issues in agreements A final potential source of disagreements within industries over free trade agreements is that other, non-trade-related policy issues may be included in the agreement terms and differentially affect firms. For example, the Generic Pharmaceutical Association opposed KORUS in part because they felt that the intellectual property protections included in the agreement were too stringent and that government procurement rules in Korea discriminated against makers of generics (USITC, 2007; CRS, 2008*b*). It is hard to systematically theorize about a residual category such as this, other than to say that it is unlikely to be correlated with neutral comparative advantage and that many of the examples of industries that were internally divided do not appear to have a clear set of 'other' issues that divided their firms as in the pharmaceutical sector.

Cases, Data and Methods

The US-Korea and US-Australia FTAs

The US-Korea Free Trade Agreement (KORUS) was negotiated from 2006-2007. It generated little public controversy in the United States, but was criticized or opposed by several important industries and many firms. In the United States, Ford and Chrysler initially opposed the agreement (even as General Motors supported it) and many beef producers also opposed the agreement due to Korean restrictions on beef imports from cattle over 30 months old stemming from BSE infections in the United States detected in 2006. Ultimately, the agreement was renegotiated to facilitate greater entry of US autos in the Korean market and the beef issue was left unresolved. This renegotiation led to passage by the US House and Senate in October 2011 of an FTA implementation act and entry-into-force of the treaty in March 2012.

The agreement was considerably more controversial in the Republic of Korea, mainly because of deep worries about the impact of US agriculture imports on Korea's smaller scale farms and food producers. Extensive street protests against the agreement persisted up until final passage in the Korean National Assembly. The Grand National Party (now Saenuri) pushed through the trade bill despite opposition legislators boycotting the session and a tear gas attack immediately before the final vote. The final tally was 151 legislators in favor, seven against, twelve abstentions and the balance of the 299 members not present.

Because of this sharp asymmetry in competitiveness in agriculture and food products, as well as mining and mineral products, I also include the US-Australia Free Trade Agreement for all agriculture and mineral-related industries. Although considerably less controversial, the agreement nonetheless sparked opposition in both countries, particularly in the agricultural sectors. Because Australia is quite competitive in the production of many agricultural products, the extent of opposition between the countries was generally much more balanced.

KORUS and AUSUS provide reasonable cases for testing the theory described in the previous section. In both agreements, nearly all sectors were liberalized either initially or within 10 years (with some notable exceptions discussed below). For example, 99% of US tariff lines and 98% of Korean tariff lines will be reduced to zero by 2022 starting from a base of 38% and 13% respectively (CRS, 2008*a*). The agreements also paved the way for reductions or controls on non-tariff barriers to trade such as government procurement rules, SPS measures, and quantitative restrictions. Certain industries were left out of the agreement, such as sugar in the United States and rice in South Korea, but these generally appear to be the exception. AUSUS similarly reduced most tariffs and quantitative restrictions with some significant exceptions for sugar in the US and wheat and other grains for Australia

(USITC, 2004).

These agreements are also valuable cases because each involves trade partners who are both reasonably large and competitive in the same types of industries as the United States. This means there is the potential for intra-industry trade, the key factor predicting intra-industry disagreement over trade liberalization. Of course, the United States is still an order of magnitude larger in terms of market size and production than Australia and Korea, which might suggest little opportunity for divisions within industries. As the evidence will show, however, a number of industries were in fact divided and some US industries were united in opposition to these agreements across all tradable sectors of the economy.

Who supported and opposed KORUS and AUSUS? Sources and coding

Which industries supported and which opposed passage of the Korea-US FTA? Which industries took no position or were divided? This section describes an approach to answering these questions by focusing on the *public* statements of trade associations and individual firms. These statements are used as proxies for the actual interests at stake for firms in particular industries.

On-the-record, public statements generally reflect an internal process of deliberation by associations and firms on the merits of an agreement and so are more likely to be well-considered and reflective of an actual interest at stake. They are also accessible across many industries and a recurring feature of debates over trade liberalization. A significant amount of effort is expended by the United States government, lobbyists, unions, businesses, industry groups and other special interests to get firms and trade associations to put their position on record publicly. Public statements are also potentially costly if member associations or industry members do not concur, or if interests are misapprehended, and so are unlikely to be hastily or erroneously formulated.

However, public positions can also create controversy and unwanted attention, especially amidst contentious debates. They may also reflect social pressures rather than being pure expressions of interest. In particular, some of the Korean associations contacted were unwilling to comment even on the question of whether their association took a public position. A particular concern here is that in industries where firms don't agree on trade liberalization, associations will simply not take a position. Nonetheless, in presenting the dependent variable below, I will argue that these public positions are good proxies for private interests. There are three reasons for this. Public positions correlate well with sensible predictors of economic interests, like import and export volumes, and comparative advantage. Second, associations and industries which took no position on the agreement were frequently in industries with higher costs of trade, little FDI or intermediate inputs, and low volumes of trade with South Korea. Finally, most of the industries that were expected to be heavily affected by the agreement (autos and auto parts, machinery, chemicals, agriculture, textiles and apparel, certain electronics) had high rates of public comment.

The unit of study here is generally the six-digit NAICS industry, using the 2012 revisions of the nomenclature. In a few instances where the products were likely to be produced by the same firms and represented by the same associations, these industries are collapsed into five-digit industries. Six-digit industries are a useful level of aggregation in many ways, and often reflective of meaningful product or organizational differences within industries. For example, eggs (112310), chicken (112320) and turkey (112330) would be conflated into one industry for any higher level of aggregation, although they are represented by different and product-specific trade associations. Allocation of firms into industries is also much more refined using this approach. Producers of metal stampings for autos are unlikely to also be involved in interior trims or transmissions.

In order to code positions of industry associations (and a few agriculture cooperatives), I have relied on association press releases and website statements; Congressional and ITC testimony, both written and oral; signature on various petitions about the agreement; and mass and trade media comments by association officers if clearly speaking for the association. If these were lacking, associations were contacted directly via email or phone, although the vast majority of replies have indeed taken no public position.

Two of these sources deserve particular attention. First, I have sparingly made use of ITAC reports – where they are unanimous and completely unambiguous – to code particular associations as being in favor of the agreement. Second, a number of associations and firms signed a petition written by the Committee to Support US Trade Laws (CSUSTL), an organization comprised of trade associations, labor unions and firms which promotes robust development and application of trade remedies to protect US business affected by trade. The CSUSTL petition "raise[d] concerns about certain antidumping and countervailing duty provisions within the Trade Remedies Section of the KORUS" and recommended that extra safeguards be added in any implementing legislation. In particular, the petition revealed otherwise unacknowledged concerns about the agreement in the flower, seafood, petroleum products, plastic bags, lime, forging, and home furniture industries. While the text of the letter is measured, I argue that it represents a separate outlet for expressing opposition to the agreement. First, many of the associations signing the letter elsewhere did express public opposition to the agreement. Second, only a small number of associations signing the letter expressed support publicly and only the smallest fraction of associations otherwise expressing public support signed the letter. Finally, note that because the letter expresses opposition, it has no impact on the testing of predictions two and three.

In coding industry attitudes, I also take advantage of expressions of support or opposition to the agreement made by firms. The vast majority of these public expressions took place in petitions or were signaled by membership in the US-Korea FTA Business Council, an organization which pushed for ratification of the FTA. CSUSTL's petition on Anti-Dumping/Countervailing Duties is again employed: 21 out of 121 firm positions, among those who opposed the agreement, are based on this source. Unlike with industry associations, where it is possible to exhaustively document associations and code those who took "no position", I content myself with simply counting the number of firms who supported or opposed the agreement in each industry. Note that most of the firms cover at least two industries, and many of the firms have wide coverage across many industries.

One concern with these petitions is that apparently meaningful expressions of

Table 3.1: Zero-inflated negative binomial regression model of counts of firms publicly expressing either support or opposition to KORUS. The results suggest that US comparative advantage is strongly negatively associated with expressions of opposition, while it is weakly linked to expressions of support. However, US exports to Korea (as well as exports as a proportion of sales, although results are not reported here) do predict expressions of support. These results support the idea that public expressions of sentiment by firms are rooted in distributive consequences of trade and are not just 'noise'. All variables but the measure of comparative advantage are on the log scale.

Predictor	Count of firms: Opposing		Favoring		Opposing		Favoring	
Neutral comp. adv.	-0.005	0.287	0.075	0.215				
US comp. adv.	-2.212^{***}	0.416	0.207	0.273				
US Sales	0.204^{*}	0.126	0.353^{***}	0.058				
US Imports from Korea					0.255^{***}	0.057		
US Imports from World					-0.054	0.098		
US Exports to Korea							0.247^{***}	0.047
US Exports to World							0.060	0.058
Number of firms	121		140		121		140	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$ from a two-tailed test with null hypothesis $\beta_j = 0$.

attitudes may be so much noise and consequently will lead to overestimation of the number of divided industries or industries with an opinion. Table 3.1 presents the results of several separately estimated event count models for the number of firms supporting and opposing the agreement in each industry. Two types of models are fit: one with a measure of comparative advantage (introduced below) with total industry sales as a control; and one with US imports from and exports to Korea, with total US imports and exports as a control. Both models suggest that counts of supporting and opposing firms are meaningfully connected to underlying economic fundamentals. In particular, while US imports from and exports to Korea predict counts of opposing and supporting firms, total US imports and exports do not.

Industries are coded from among {Oppose, Divided, Favor, No position}. Any

Table 3.2: This table contains counts of US industries by position for the KORUS and AUSUS agreements. The impact of various sources of preferences on the distribution of industty positions is considered for KORUS. Counts are supplemented with proportions weighted by industry sales to illustrate that counts of divded industries, for example, are not simply a consequence of small industries.

Agreement	Actors	AD/CVD	Oppose	Divided	Favor	No pos.	Missing	Total
KORUS	Associations only	No	8	20	189	32	115	364
			0.006	0.119	0.621	0.103	0.151	1.00
		Yes	21	27	183	28	105	364
			0.031	0.146	0.598	0.092	0.132	1.00
	Associations	No	14	37	195	19	99	364
	& Firms		0.036	0.160	0.665	0.028	0.112	1.00
		Yes	20	46	187	19	92	364
			0.044	0.188	0.641	0.028	0.099	1.00
AUSUS	Associations only	No	20	2	20	11	56	109
			0.299	0.040	0.314	0.043	0.304	1.00

association I have not heard a definitive "No position" from, is classified as missing data and generally omitted from the analysis. Industry codings are in turn built on actor codings as described above. If an industry has even one association taking a position from among {Oppose, Divided, Favor}, then the industry is coded in that manner, even if other associations took no position. If multiple associations conflict in their position, then the industry is coded as divided. An industry is also coded as divided if an association was explicitly neutral and cited disagreement among its firms (or varying effects on members from the agreement). Counts, and proportions weighted by sales, of all the industry codings based solely on association positions are reported in the first two rows of Table 3.2.

The second half of Table 3.2 reports the counts and weighted averages of the industry codings when firm attitudes are also included. Firms in an industry are coded as favoring or opposing the agreement if three or more signed on with a given position. These groups of firms are then treated equivalently to an association. For example, an industry with a single association favoring the agreement and 3 or more firms opposing the agreement is coded as “divided". Note that the number of industries coded as divided based only on association preferences are quite significant, and division is in fact far more common than unqualified opposition. Second, the number of industries coded as divided and opposed increases substantially when firm attitudes are taken into account.

Finally, there were a number of industries which avoided significant liberalization in part or as a whole in these agreements. These cases are relatively few but of course are disruptive to the results because comparative disadvantage industries, for example, might support the agreement only because they avoided any liberalization. In order to handle these cases, which are relatively few, four industry attitudes were imputed as described in Appendix A. Only one of these industries was coded as divided.

Measuring comparative advantage

I develop a model-based approach to measuring costs of production based on the model presented in Melitz and Ottaviano (2008). Assuming that both countries have similar demand structures for each good, average costs of production and country size are the only source of comparative advantage in the model. Specifically, the paramter m^l determines the support of the Pareto distribution from which firms draw a stochastic cost of production. These parameters are best conceptualized as either differences in technology and or in the quality of unpriced inputs.

The measure is derived as follows. Total sales in the domestic market (l) and exports from l to h are given by

$$R_D^l = \frac{L^l}{2\gamma(k+2)(m^l)^{-k}} N_e^l (c_D^l)^{k+2}$$

and

$$R_X^l = \frac{L^h}{2\gamma(k+2)(m^l)^{-k}} (\tau^h)^{-k} N_e^l (c_D^h)^{k+2}.$$

N_e^l is the number of entering firms in l (before any exit), k is the skewness of the Pareto distribution, L^l is the number of worker/consumers, and γ is the extent of product differentiation. In a long-run equilibrium, the zero-profit productivity cut-off c_D^l is equal to

$$\left(\frac{\gamma}{L^l}\frac{\phi^l - (\tau^h)^{-k-1}\phi^h}{1-(\tau^h)^{-k-1}(\tau^l)^{-k-1}}\right)^{\frac{1}{k+2}},$$

where $\phi^l = 2(k+2)(k+1)(m^l)^{-k}$ and ϕ^h is defined analagously. Dividing exports by domestic sales, we have:

$$\frac{R_X^l}{R_D^l} = \frac{\phi^l - (\tau^h)^{-k-1}\phi^h}{(\tau^h)^{-k}\left(\phi^h - (\tau^l)^{-k-1}\phi^l\right)}.$$

This then yields an expression for relative costs of production between the two countries :

$$\frac{m^h}{m^l} = \left(\frac{\frac{R_X^l}{R_D^l}\left(\tau^h\right)^k + \left(\tau^l\right)^{-k-1}}{\frac{R_X^l}{R_D^l}(\tau^h)^{-1}+1}\right)^{\frac{1}{k}}.$$

This expression recovers underlying relative costs of production taking full account of barriers to trade[3]. For example, holding the export-to-domestic sales ratio constant, the measure is increasing in foreign trade barriers and decreasing in domestic trade barriers. If trade barriers are measured accurately, the measure will reveal that countries facing very high trade barriers have lower costs of production

[3] Note also that comparative advantage, which is defined for this application as relative average

despite seemingly low export volumes. This is, in principle, an improvement on ad hoc measures of comparative advantage like revealed comparative advantage, import- and export penetration, and import-export ratios. This measure can also be viewed as an adjusted measure of exports as a percentage of total production, $R^l_X/(R^l_D + R^l_X)$, which the measure collapses to when trade barriers are high at home and low abroad.

One useful feature of this measure is that it relies on observable quantities. The easiest among these to measure are exports and sales by industry. For the US data, these are measured using 2007 Census of Agriculture, Census of Mineral Industries, and Census of Manufacturers data on total sales. Imports and exports to Korea and Australia are taken from US International Trade Statistics, an online tool managed by the Census Bureau. Trade barriers are obviously less well measured. I employ 2007 measured tariffs and *ad valorem* equivalents, where available, of non-tariff barriers, both taken from the WITS database. An ad valorem measure of maritime shipping costs from the United States to East Asia provided at the HS two- (and in some cases six-) digit level is employed to measure trade costs. This measure

prices in autarky is equal to

$$\begin{aligned} \frac{\bar{p}^l_A}{\bar{p}^h_A} &= \frac{c^l_A}{c^h_A} \\ &\propto \left(\frac{L^l(m^l)^k}{L^h(m^h)^k}\right)^{\frac{1}{k+2}} \end{aligned}$$

Note also that the measure is relatively insensitive as trade barriers in both countries go to zero (i.e. as $\tau \to 1$). This is a consequence of the use of long-term equilbria, which are necessary to have an explicit solution for the cutoffs. As trade barriers go to zero, no firms will enter in the market with worse technology.

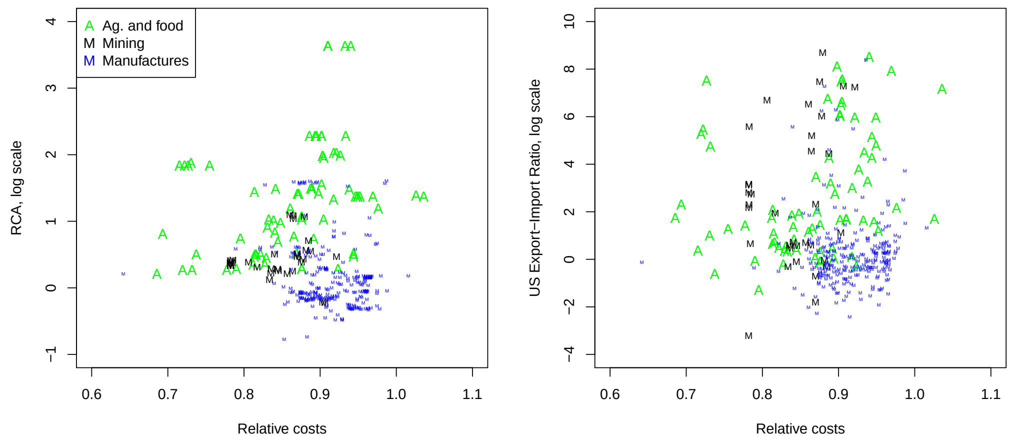

Figure 3.1: This figure plots the measure of comparative advantage developed here (before recentering) against two commonly-employed proxies, revealed comparative advantage and the ratio of US exports to imports. Only the US-Korea data is used here. Both of the latter are on the log scale, so the US and its trade partners are "even" for all three measure at unity.

is published by the IMF. These three components are summed together to measure τ^h and τ^l. The only other required parameter is k, the skewness of the assumed Pareto distribution of firm productivities. Here I assume k is equal to 3, which is a close match to the figure employed in numerical simulations by Bernard, Redding and Schott (2008). This does not vary across industries.

Figure 3.1 plots the measure against two existing proxies for comparative advantage, Balassa's revealed comparative advantage and the United State's export-import ratio with the Republic of Korea. Three patterns stand out. First, the measure is in general too low. South Korea is estimated to have lower costs in virtually every product category, including much of agriculture. This in part reflects unmeasured trade barriers and costs of trade. Korea has an extensive set of non-tariff barriers to agricultural inputs and many minerals and mineral products are likely to have high shipping costs not entirely captured in the maritime trade costs measure, which is at a somewhat high level of aggregation. More importantly, it probably reflects 'home bias' in consumption (Trefler, 1995; Wolf, 2000; McCallum, 1995). Second, there is surprisingly little correlation between existing proxies for comparative advantage. In part, this reflects mismeasurement or conceptual difficulties associated with all of the approaches, but is also in part caused by very poor estimation of relative costs in agriculture and minerals, two areas of real strength for the United States relative to South Korea. Finally, within the groups defined in the figure, the correlations are somewhat improved, with the exception of manufacturing.

In order to address some of the problems described above while retaining a parsimonious measure, I recenter the relative costs measure so that exact neutrality (relative costs = 1) between the US and Korea occurs at the 15th, 30th, and 50th percentile for agriculture and food, mining and mineral products, and manufacturing, respectively. For the US and Australia, exact neutrality is assumed to occur at the 50th percentiles for both agriculture and food, and mining and mineral products. These are somewhat arbitrary shifts but the resulting categorization of industries are quite plausible. This measure will generally be referred to as the 'relative costs' measure of comparative advantage. When it is less than 1, Korean or Australian costs are lower than American costs of production, on average.

In order to create a variable for comparative advantage that further improves on that described above, I propose the following discretized measure:

1. Treat agriculture and food; mining and mineral products; and other manu-

facturing separately.

2. For industries which are the most extreme on either the relative costs or RCA measure, code the industry as comparative advantage or disadvantage, as appropriate.

3. Then bin all industries which are reasonably high or low on *both* measures as appropriate, leaving the rest of the industries as neutral.

4. Do a final sweep involving relative import-exports. For industries where this ratio is reasonably close to one, and total imports and exports exceed a threshold figure, code the industries as "neutral".

The final codings using this approach are more plausible than the measures provided by any one approach and compensate for some of the weaknesses of any individual approach. This measure has a Spearman correlation of $.612$ with the more parsimonious measure described above. In general, this discrete measure is used for plotting and the continuous measure is used for most statistical modeling.

Finally, two additional measures of comparative advantage are employed to check the robustness of results to alternative measures. The first of these is the natural logarithm of the ratio of US exports to the trade partner divided by US imports from the trade partner. All zeros are replaced with 1 if at least one other country has positive exports, otherwise the measure is missing. The correlation of this measure with the relative costs measure above is $.227$. I also use Balassa's revealed comparative advantage measure, which is provided through UNCTAD's WITS database. This measure is the natural logarithm of the ratio of the revealed comparative advantage of the US and its trade partner and has a correlation of .391 with the relative costs measure.

Other key covariates

The Rauch (1999) coding of industries into exchange-traded, reference-priced and differentiated goods is used as the primary proxy for product differentiation. These codes are measured in four digit SITC revision 2 products, and are concorded with appropriate six-digit NAICS industries. Where there are disagreements, the modal SITC coding is used. As a secondary measure, I use the Grubal-Lloyd index of intra-industry trade for total US trade with the world. This is of course a quite noisy measure of product differentiation because it conflates two conceptually distinct phenomena: consumers' taste for variety and comparative advantage of US industries relative to the world. The Spearman correlation of the Rauch and intra-industry trade measures is .163. As a secondary measure, I use a trichotomous version of the import elasticity of substitution from Broda and Weinstein (2006). The idea is that homogeneous products should be more sensitive to price changes than differentiated products. The Spearman correlation of the Rauch and elasticity-based measures is .208.

Data on foreign direct investment by the United States and other countries is only available at a relatively high level of aggregation, usually the two- or three-digit NAICS code. There is however data on worldwide FDI by American businesses at the four-digit NAICS level. I therefore consider two measures of the extent of US multinationalization by industry. The first measure is the percentage of US

FDI in Korea and Australia which is in an industry's three-digit sector. The second assumes that US FDI in South Korea and Australia is distributed similarly to US FDI worldwide within three-digit industries. This measure is therefore available at the four-digit NAICS level. This is again a percentage of total US FDI. Naturally this introduces some noise, especially because FDI occurs in narrowly tailored chunks rather than being smoothly distributed. For these two agreements, the largest percentage of FDI by two-digit industry is accounted for by mining in Australia (at more than 60% of total US direct investment in Australia). The largest percentage of imputed FDI for a four-digit industry in South Korea is electronic components (15.2%).

In order to capture the extent of US reliance on imported inputs, I make use of the BEA Input-Output tables from the 1997 Economic Census. Input-output tables are available at the 6-digit level, and I set inputs on all diagonals to zero to avoid conflating import competition with input usage. I further assume that each foreign and domestic input is distributed across industries equally. The measure then captures for each industry the proportion of the final value of products that is accounted for by foreign inputs from either Korea or Australia, as appropriate. This measure is also disaggregated by the extent of product differentiation so, for example, none of the value of US autos and light trucks is accounted for by undifferentiated Korean products while $.08\%$ of the value is accounted for by differentiated Korean products (mostly auto parts). The most reliant US industry is "telephone apparatus", while flour and rice milling, for example, have effectively no reliance.

Methods

Before turning to the evidence, there are several methodological issues which apply throughout the analysis and are helpful to address at the outset. The presentation of the evidence relies on graphical presentation of the simplest versions of the hypotheses (e.g. that divisions are increasing in the extent of product differentiation). Simulations and regression results are generally presented for the full versions of Predictions 1-4. Clear quantities of interest are generally provided in the text to provide a sense of effect sizes.

Confounding: In the economic model which underlies the hypotheses tested here, it is assumed that product differentiation and comparative advantage are determined by exogenous factors (consumer love-of-variety; and technology and market size). Here, I assume a one-to-one correspondence between the proxies for product differentiation and consumer love-of-variety. It is also assumed for a given industry and country, that domestic market size for that product is a constant proportion of the total market size of the country. In other words, only the total market size influences comparative advantage and the only varying determinant of comparative advantage across industries is technology. These three forces jointly determine the extent of support in the industry and any residual sources shaping industry preferences are assumed to be uncorrelated with these predictors.

To consider violations of this unconfoundedness assumption, it helps to consider love-of-variety and technology separately. The attitude adopted here is that love-of-variety is a product of an underlying consumer preference for variety as well as taste-, cost- and technology-based constraints on the possibility/desirability of variety. These are all intrinsic (and highly static) properties of goods and people and it is difficult to name prior determinants which would confound industry attitudes towards trade liberalization. On the other hand, technology is both more dynamic and subject to choice, and so may be confounded. Nonetheless, it is difficult to identify prior causes of technology differences which feed into industry attitudes, but not via the technology channel.

Alternative explanations as mediators: Because of the assumed exogeneity of the main explanatory factors, the primary empirical challenge here concerns causal mediation (Baron and Kenny, 1986). Does product differentiation affect intra-industry divisions, for example, via its effect on intra-industry trade or on the extent of foreign direct investment? The main approach to this problem is to consider changes in regression coefficients when post-treatment mediators are introduced to the model. The validity of this approach relies on relatively stringent assumptions about effect homogeneity, linearity of the predictors and unconfoundedness of the mediator (Glynn, 2012; Green, Ha and Bullock, 2010). Moreover, this approach can result in bias in the generalized linear models employed here. Imai et al. (2011), in addition to providing a complete treatment of this issue using potential outcomes with discussion of necessary assumptions, also explain how to handle non-linear models. Estimates of certain crucial quantities using their method will be provided in footnotes.[4]

[4] These estimates rely on a "sequential ignorability" assumption (Imai, Keele and Yamamoto, 2010). The first part of the assumption is that treatment assignment (here product differentiation and comparative advantage) is independent of potential outcomes of both the mediators and outcome.

Grouped errors: Observations within industry subgroups are probably not entirely independent within this data, even conditional on the predictors. Two solutions are considered. First, standard errors clustered at the three- and four-digit NAICS level (for each country) are estimated and reported in Appendix B. There are generally not substantial increases in the usual standard errors (nor decreases, for that matter) and patterns of significance remain the same. Second, a series of random effects models are estimated to directly model cluster-specific intercepts, again at

This was assumed above. The additional assumption required is that conditional on a set of treatment values, the mediator value assignment is independent of the potential outcomes. To see what this means, it helps to consider fixing the level of comparative advantage and focus on changing the level of product differentiation. Conditional on a level of product differentiation, are there likely confounders of FDI or reliance on foreign inputs and intra-industry divisions, for example? Earlier it was argued that FDI is driven by some factors that are in our treatment set (product differentiation and comparative advantage) and some that aren't (like shipping costs; firm-, rather than plant-, level economies of scale; and transactions costs). The former are clearly not a problem, but the latter will be if they confound intra-industry divisions or likelihood of support, for example. Shipping costs are unlikely to do so because they affect both countries symmetrically. The level of aggregation at which economies of scale occur and the existence of transactions costs also seem unlikely to affect the outcomes systematically, except via their effect on FDI. The extent of reliance on foreign inputs is also largely going to be driven by factors with no effect on industry positions except via their effect on the extent of imported inputs.

All of the footnoted estimates rely on the methodology explained in (Imai et al., 2011). For the mediator model, I employ a vector linear regression model to simulate values of the four potential mediator variables simultaneously. Estimates are provided of the average direct effects of changes in product differentiation for when the 'mediator treatment' is set to 'Homogeneous' or fully 'Differentiated'. Comparative advantage is set at its median value.

the three- and four-digit NAICS levels. These are reported in Appendix B. These models directly account for potential correlation between cluster-specific effects and predictors, and are particularly valuable when the number of clusters is small (as with the three-digit NAICS clustering). Note, however, that random effects may produce biased estimates in the presence of correlation between cluster effects and covariates. As Clark and Linzer (2012) point out, however, this bias is preferable under a wide array of circumstances to the enormous variability in estimates induced by fixed effects estimators, especially where the number of observations per cluster is small, as is the case here. In any event, for every random effects model estimated a Hausman test comparing the random effects model to a fixed effects models was conducted (all GLMs are linearized for this test). None of the test statistics were large enough to justify the use of a fixed effects specification.

Evidence

I now turn to the evidence. Recall that three surprising outcomes, at least from the perspective of the standard models of trade politics, are predicted in industries producing differentiated products: intra-industry disagreement over whether to support or oppose freer trade; support for the FTA in both countries in the same industry; and, support for the agreement in comparative disadvantage industries. The first two outcomes are expected, in particular, in industries where neither country has an overwhelming comparative advantage. All three of these predictions are validated by the data and the estimated impacts of product differentiation on each of these outcomes are large.

This section also examines two alternative explanations of these outcomes: variation in multinationalization and variation in the reliance on foreign inputs. The contention that industries relying on differentiated products are more likely to feature each of these outcomes is consistently supported. FDI, however, does not appear to drive intra-industry divisions (or support in both countries) in any significant fashion. In addition, the inclusion of measures of FDI and reliance on foreign inputs do not substantially alter the results described in the previous paragraph. The links between product differentiation, comparative advantage and intra-industry divisions are not simply products of these two alternative explanations.

Intra-industry divisions

Under what circumstances do industries have both supporters and opponents of trade liberalization? The first finding here is that US industries producing differentiated products are far more likely to have internal divisions than those producing homogeneous products. This relationship is presented graphically in the top half of Figure 3.2, which gives rates of support, opposition and division across the sampled industries. There are only a small number of industries producing undifferentiated products who were internally divided over the FTAs, while around 20% of industries producing moderately or highly differentiated products were internally divided.

The lower half of Figure 3.2 presents the breakdown of support, opposition and division by the discrete measure of comparative advantage described above. Two interesting patterns are present. First, the number of US industries with divisions

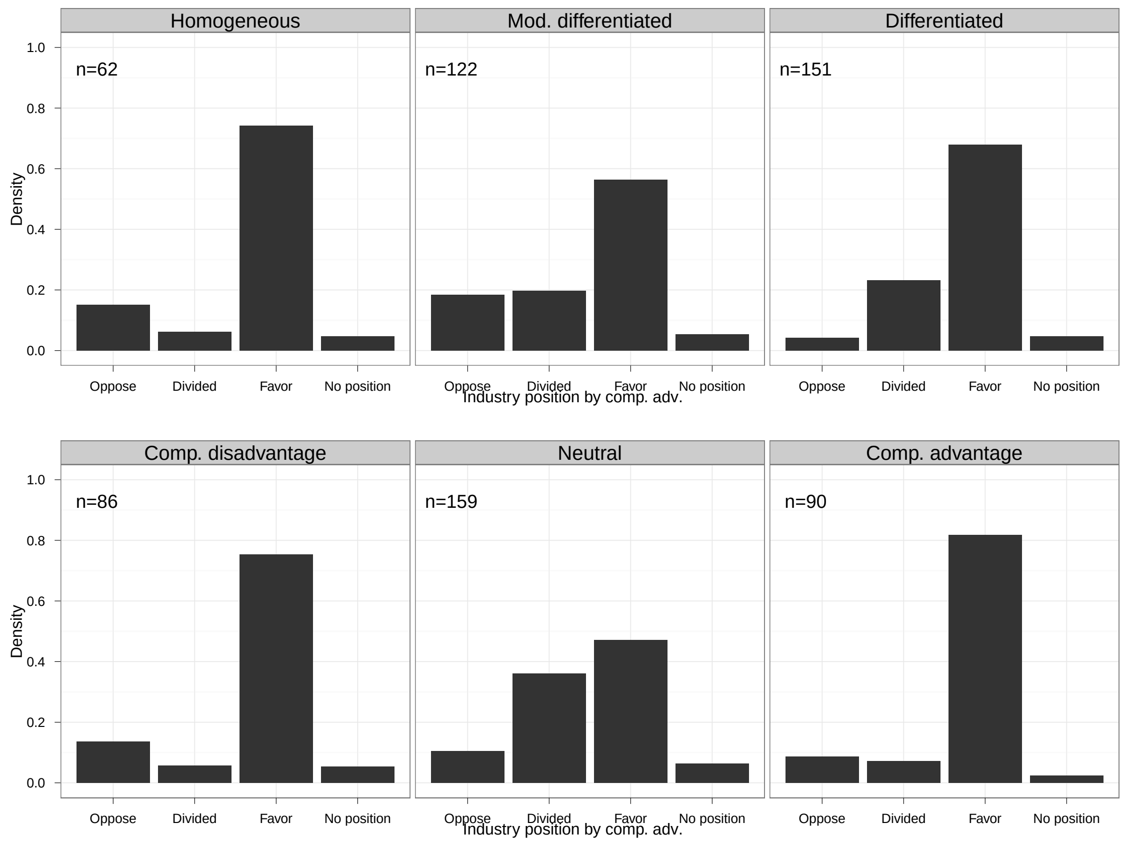

Figure 3.2: This figure provides the breakdown of US industry attitudes separately by product differentiation (top half) and US comparative advantage relative to its trade partners. Industries producing differentiated prodcuts are much more likely to feature divisions. Industries with no clear comparative advantage or disadvantage relative to their foreign competitors are also more likely to feature intra-industry divisions. A number of comparative disadvantage industries appear only to support the agreement, however.

is noticeably higher in industries that are roughly competitive with their foreign rivals. Relatively few industries at a noticeable comparative disadvantage or advantage were divided over the agreement. Second, a significant number of industries coded as being at a comparative disadvantage *supported* the agreement, with no divisions whatsoever. This is surprising and of course inconsistent with the fullest version of the theory as presented above, which would predict united *opposition* in comparative disadvantage industries.[5] The existence of support in comparative disadvantage industries will be examined in some detail later on, as a potential manifestation of firm heterogeneity.

Figure 3.3 presents the core result on the extent of intra-industry divisions from a parametric analysis. I estimated a multinomial logit model using only industries coded as favoring, opposing or divided on the two FTAs. Industries with no position or missing attitudes are left out to avoid problems with perfect separation of

[5] There appear to be a couple of forces at work. First, in certain highly uncompetitive industries for the United States, there is relatively little remaining domestic production except among highly successful global brands, reflecting the process described in Hathaway (1998). For example, the apparel industry is largely coded as supporting the agreement although trade flows are sharply in favor of South Korea. Of course, sourcing inputs and foreign production may also be playing a role here. The lack of opposition could reflect Korea's steadily deteriorating competitive position relative to other exporters of apparel to the US. A second group, composed mostly of plastic and rubber products, is somewhat more mysterious. In 2012, US imports of these products from Korea were around $2.5 billion while exports were only $290 million. Trade in specific goods, like tires, is even more asymmetric, yet the major rubber and tire industry associations supported the agreement and there was no visible protest from individual tire producers. Note also that both US and Korean tire tariffs were cut in the agreement.

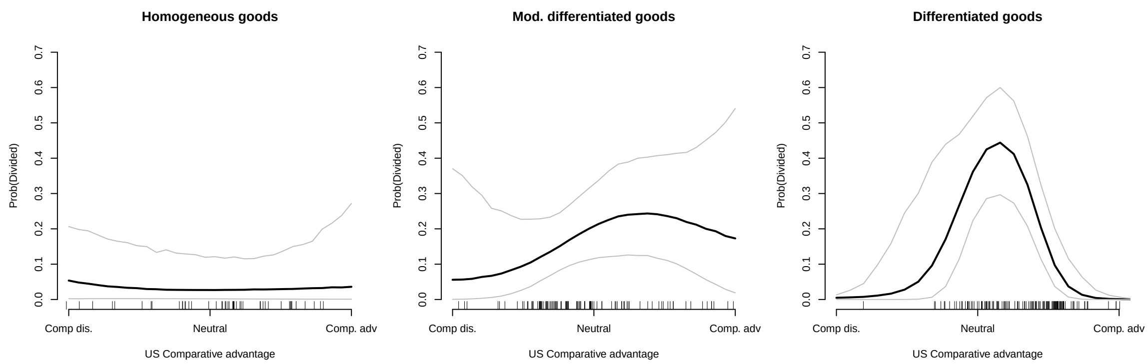

Figure 3.3: This figure plots predicted proportions of divided industries using results from a multinomial logit model, which includes only industries which took a public position. Homogeneous goods are generally predicted to have very few divided industries, with no clear relationship to comparative advantage. Highly differentiated product industries have divisions only where comparative advantage is moderate, while somewhat differentiated industries have divisions where comparative advantage is moderate or in favor of the United States. Note that the range of comparative advantage is $.85$ to 1.2 for homogeneous and moderately differentiated goods, and $.85$ to 1.1 for fully differentiated goods.

the outcomes by the predictors. The main predictors in the model are the trichotomous measure of product differentiation interacted with the continuous measure of comparative advantage and its squared term.[6] This permits the expected non-linear effect of comparative advantage to express itself. Figure 3.3 shows the estimated proportion of divided industries as a function of both product differentiation and comparative advantage.

[6] The score function for outcome k in the model is given by

$$\lambda^k = \boldsymbol{\beta}^k(1 + \mathrm{I}_{\mathrm{Mod.diff}} + \mathrm{I}_{\mathrm{Diff.}})(1 + \mathrm{CA} + \mathrm{CA}^2).$$

$I_{\mathrm{Mod.diff}}$, for example, is an indicator variable for the level of product differentiation being 'moderate' according to the Rauch (1999) measure. Homogeneous goods are used as a baseline category here and throughout. CA stand for a continuous version of the relative costs measure for comparative advantage, which is described above. $\boldsymbol{\beta}^k$ is a vector of length nine and, for example, β_1^k fits an intercept term.

Three results from the model are clear. First, there are very few divided industries predicted when product differentiation is low. Second, there is a non-linear effect of comparative advantage on the proportion of industries with divisions, and only US industries at a slight comparative disadvantage or at parity with their foreign competitors are predicted to have internal divisions. This relationship is especially sharp for the highly differentiated products. Third, the substantive effects predicted by the model are very large. Consider moving from a homogeneous good industry to a moderately or fully differentiated good industry when the comparative advantage measure is set at its median (roughly 1.02). The predicted increases in the number of divided industries are $.177$ and $.264$, respectively, and the confidence intervals for these estimates exclude zero.[7]

These results are presented in a slightly different format in the first model in Table 3.3 in order to facilitate presentation of alternative specifications in the next section and the appendix. A logistic regression model is estimated whose outcome is a dichotomous measure of whether or not the industry was divided.[8] The linear predictor again employs the Rauch (1999) measure of product differentiation interacted with linear and squared terms for the continuous measure of comparative advantage. All lower order terms are estimated as well. The model predicts

[7] When the US is at a comparative disadvantage ($CA = .92$) these effects are negligable ($-.001$ and $-.048$) and not significant. When the US is at a comparative advantage ($CA = 1.15$), there is a statistically significant increase in divisions of around $.233$ for moderately differentiated products and $.038$ for differentiated products. These two figures are the $.05$ and $.95$ percentile for the comparative advantage measure, respectively.

[8] All missing industries are omitted from the analysis.

Table 3.3: Reports regression results from a logistic regression which uses 'divisions' as an outcome. The interactions between product differentiation and comparative advantage show the expected signs, if not statistical significance. FDI, which is measured here at the four-digit NAICS level, has little effect on the existence of divisions. Imports of undifferentiated inputs are also not linked to divisions, while imports of moderately and fully differentiated inputs are positively associated with intra-industry divisions.

		Model 1		Model 2		Model 3		Model 4	
Variable	Exp. sign	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Intercept		8.964	14.170	-8.203	3.011	5.772	14.176	-8.053	15.529
CA	0	-0.232	0.229			-0.280	0.229	-0.020	0.242
$(CA)^2$	0	0.001	0.001			0.001	0.001	0.000	0.001
Mod. diff.*CA	+	1.642	1.060			1.591	1.132		
Mod. diff.*$(CA)^2$	-	-0.007	0.005			-0.007	0.005		
Diff.*CA	+	12.766^{**}	5.052			14.973^{***}	5.492		
Diff.*$(CA)^2$	-	-0.064^{**}	0.025			-0.075^{***}	0.027		
IIT*CA	+							0.807	0.983
IIT*$(CA)^2$	-							-0.004	0.005
FDI	+			-7.972	7.254	-5.643	7.444	-8.108	7.426
log(Sales)				0.271^{**}	0.130	0.289^{**}	0.140	0.240^{**}	0.137
Undiff. inputs	0			-0.212	0.699	-0.138	0.790	-0.226	0.840
Mod. diff inputs	+			0.244^{**}	0.110	0.184^{*}	0.102	0.215^{*}	0.109
Diff. inputs	+			0.125^{*}	0.070	0.168^{*}	0.090	0.122^{*}	0.072
Sample size		334		334		334		334	
LRT Comp		Intercept only		Intercept only		Model 2		Model 2	
LRT p-value		1.462e-05***		5.817e-05***		5.439e-05***		0.574	

$^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$ from a two-tailed test with null hypothesis $\beta_j = 0$.

positive coefficients for the linear terms of the comparative advantage measure interacted with measures of product differentiation and negative coefficients for the squared terms. This pattern is observed, although only the interactions with fully differentiated industries are significantly discernable from zero at the $.05$ level.

Alternative explanations

Are the alternative explanations of divisions within industries, which are on their own quite plausible, driving these results? Because comparative advantage and consumer love-of-variety are exogenous, at least within the model of trade employed here, this boils down to a question of decomposition of the effects. For example, does product differentiation lead to intra-industry divisions because of its interaction with firm heterogeneity in exporting or because differentiated product industries feature more foreign direct investment?

The models with measures for the alternative explanations are again presented in Table 3.3. Three results are worth noting. First, the generally nonlinear relationship between comparative advantage and intra-industry divisions is only present in industries producing differentiated products and is not affected by the inclusion of measures of US FDI in Korea and Australia, or the measures of US reliance on imported inputs. The effect sizes are also remain substantively interesting.[9]

[9] Using results from Model 1, when the comparative advantage measure is set at its median, the proportion of divided industries is significantly larger in both moderately and fully differentiated good industries compared to homogeneous good industries. 95% confidence intervals for these changes are $(0.052, 0.269)$ and $(0.128, 0.375)$, respectively. No significant differences occur when the comparative advantage measure is set to its 10th percentile and 90th percentile for fully differentiated industries, and only for the former in moderately differentiated industries. The respective confidence intervals are $(-0.042, 0.171)$ and $(-0.003, 0.398)$; and $(0.057, 0.387)$ and $(-0.134, 0.011)$. This is similar to the result from the multinomial logit model (shown in Figure 3.3) where the divisions are most prevalent in neutral industries or industries at a comparative advantage, when the good is somewhat differentiated.

The estimates of the average direct effects (Imai et al., 2011), when comparative advantage is set to 1.02, are still significant. For example, the predicted increase in probability of divisions when going from a homogeneous to a differentiated good is 0.206 when the mediator treatment is set to differentiated and 0.164 when the mediator treatment is set to homogeneous. The respective

Second, there does not appear to be any strong positive link between foreign direct investment and intra-industry divisions across the entire data. Separate regression results [not reported] of industry responses on various measures of FDI show similar results. If anything, there is a negative observed relationship between the extent of FDI and intra-industry divisions. As previously noted, however, these measures of FDI are at a relatively high level of aggregation and suffer from some measurement error. Clearly this is an area for further investigation in the future.[10]

Third, there is some evidence of a significant relationship between the extent of reliance on foreign inputs and intra-industry divisions. As predicted, this is only the case for inputs which are not homogeneous. To get some sense of size of the effect, consider an increase in the extent of reliance on foreign inputs from its 25th percentile to its 75th percentile using the estimates from Model 3. For homogeneous inputs, there is no predicted increase in the probability of intra-industry divisions (the confidence interval is $(-0.002, 0.001)$). In contrast, for moderately differentiated and differentiated goods, the predicted increases are 0.01 and 0.03 (with respective confidence intervals $(-0.001, 0.023)$ and $(-0.002, 0.075)$). These effects are not quite significant at the five percent levels and are modest substantively.

confidence intervals are $(0.009, 0.518)$ and $(0.029, 0.598)$.

[10] It was earlier argued that vertical FDI is most likely to give rise to these divisions. One crude way of testing this claim is by interacting the FDI variable with a dummy for comparative disadvantage of the US industry, on the theory that FDI only activates opposition when the foreign producers are exporting back to the US. These interaction terms do have the expected sign (FDI is positively correlated with divisions in comparative disadvantage industries) however the effect is not significant. Moreover, the coefficients on the main set of predictors remain unchanged.

Alternative measures of product differentiation and comparative advantage

How robust are the findings presented thus far to alternative measures of the most important variables? A series of robustness checks are presented both graphically and numerically in Appendix B, and summarized here to save space. As a first check, I consider an alternative approach to product differentiation and comparative advantage using the intra-industry trade between the United States and its two trade partners (in 2007). The idea is that intra-industry trade should be low either if the product is homogeneous or if one country has vastly more productive firms than the other. If intra-industry trade is high, then it is likely that there will be both supporters and opponents of trade liberalization. Of course, this approach does not take account of existing tariffs and trade barriers, which were extremely high between the countries in certain industries.

Using the continuous version of the Grubel-Lloyd index of intra-industry trade, there is a positive but not statistically significant relationship between intra-industry trade and intra-industry divisions in the data.[11] About 17% of industries have no intra-industry trade whatsoever, and it is estimated that moving from no intra-industry trade to positive intra-industry trade increases the probability of intra-industry divisions by around $.13$. About 33% of industries have an IIT index of less than $.05$ and the difference in probability of divisions between these two groups is 0.094.[12] These results are not conclusive, but they are consistent with Prediction 1.

A second set of robustness checks considers two alternative measures of product

[11] The model results are presented in Appendix B.

[12] The confidence intervals for the preceding two estimates are $(0.040, 0.188)$ and $(0.023, 0.163)$.

differentiation: the Grubel-Lloyd index of intra-industry trade for all US imports and exports, and a trichotomous version of the elasticities of substitution estimated in Broda and Weinstein (2006). The first of these is presented in Model 4 of Table 3.3. The extent of intra-industry trade shows the expected sign and size, although it is not significant at the $.05$ level. The results from models with the elasticity proxy are presented in Appendix B and are generally signed correctly and in some cases significant, depending on the measure of comparative advantage.

Two additional measures of comparative advantage are also explored here. When interacted with the Rauch measure of product differentiation, both measures support the idea that product differentiation is associated with intra-industry divisions, however they complicate the picture on the role of comparative advantage. US industries producing differentiated products are most likely to be divided if they are at a *comparative disadvantage* relative to their foreign competitors.

The data on industries with divisions over KORUS and AUSUS provide relatively strong support for the claim that product differentiation is associated with intra-industry divisions over trade. Note, however, that the modal attitude toward the agreement remains unqualified support (at least as observed publicly) and that divided industries are always a minority of industries. The claim that industries at neither a strong comparative advantage nor disadvantage are most likely to be divided finds some support. While there is evidence of this pattern using my preferred measure of comparative advantage (and the raw intra-industry trade index between the countries), various alternative measures of comparative advantage suggest that comparative disadvantage industries are most likely to have divisions.

Support in both countries

In this section, I pair the responses of US industries to the Korea and Australia FTAs with their competitor industries abroad in order to examine Prediction 2. The coverage of the data is much more limited, primarily because the overall rate of public pronouncement among South Korean associations was much lower than among US associations. Alternative sources, such as public petitions, were also not manifest. When contacted, a number of even the largest associations preferred not to comment even on the question of whether they did or did not have a public position. Still, enough Korean and Australian associations did make public pronouncements or respond when contacted to permit some investigation of Prediction 2.

Recall that the second prediction coming out of this model was that in industries producing differentiated goods, and where comparative (dis)advantages are not too sharp, we should be likelier to see support for the agreement in both countries. The equivalent statement about opposition is also true and there are indeed some industries where there was opposition in both countries. However, opposition is generally harder to observe for the reasons described above so these cases are not considered.

Focusing only on product differentiation, there is strong support for the claim that differentiated product industries are more likely to feature support in only one trade partner. This is presented visually in Figure 3.4.

Simulations from a parametric model are also presented in Figure 3.5 in order to consider how comparative advantage interacts with product differentiation. The model is a penalized logistic regression where the dependent variable is support

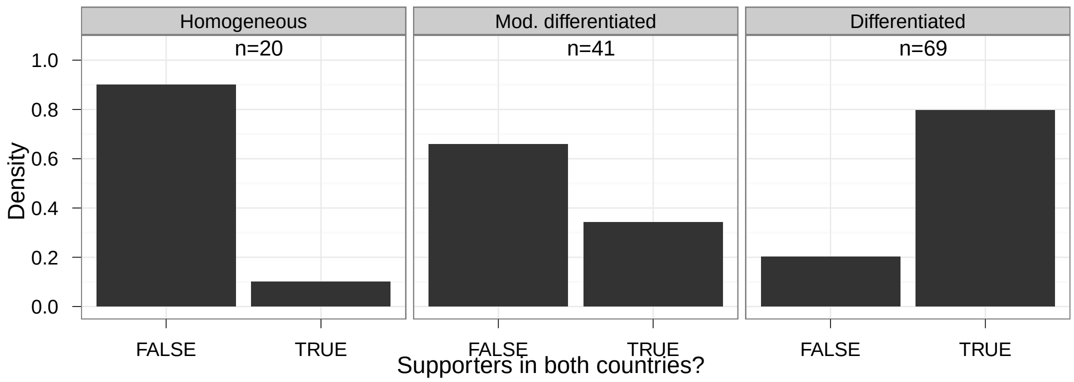

Figure 3.4: This figure plots the proportion of industries where both countries have supporters as a function of product differentiation. Product differentiation is strongly linked to this occurence.

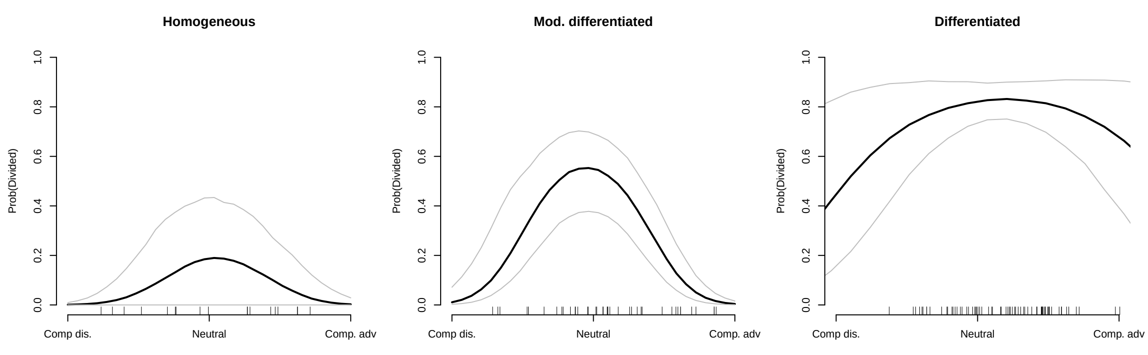

Figure 3.5: This figure plots predicted probabilities that both the US and trade partner industry will have supporters of trade liberalization, as a function of product differentiation and comparative advantage. The statistical model is a penalized logistic regression, in order to deal with perfect separation, and the confidence bands are bootstrapped. The plot suggests strong support for Prediction 2 among moderately differentiated industries but a full test is not available for fully differentiated industries becuase of a lack of variation in the compararative advantage measure.

in both countries. The predictors are again the interaction of product differentiation and comparative advantage.[13] In industries producing homogeneous goods, support in both countries is generally rare. For moderately differentiated goods, support in both countries is much more common and is closely associated with moderate levels of comparative (dis)advantage, in accord with the second prediction. In industries producing the most differentiated products, support in both countries is common. However, there is not strong evidence of the hypothesized non-linear role of comparative advantage on the range of the relative costs variable available for this outcome.

Table 3.4 considers again a range of parametric models but uses a linear probability model (rather than the penalized regression above) to handle the issue of perfect separation. Model 1 presents the baseline case which again shows how the non-linear effect of comparative advantage is dependent on the product being differentiated. As with the divisions variable, the size of the estimated effects of increases in product differentiation are very large. The following comparisons use Model 1. When the comparative advantage measure is set to its median, moving from a homogeneous to a moderately or fully differentiated product is predicted to increase the probability of both industries supporting the agreement by 0.390 and

[13] Penalized regression is used here because of problems arising from perfect separation of the outcome by the predictors. Again, the linear predictor of the model is given by

$$\lambda = \boldsymbol{\beta}(1 + \mathrm{I}_{\mathrm{Mod.diff}} + \mathrm{I}_{\mathrm{Diff.}})(1 + \mathrm{CA} + \mathrm{CA}^2),$$

where $\boldsymbol{\beta}$ is a length nine vector of coefficients. The Rauch measure of product differentiation and the relative costs measure of comparative advantage are employed for the baseline results.

0.719, respectively.[14] When the US industry is at a strong comparative advantage or disadvantage, however, these effects are near zero (if moving from homogeneity to moderate differentiation) or smaller but statistically insignificant (if moving to full differentiation).[15]

Alternative explanations

Table 3.4 also considers FDI and imported inputs as alternative explanations. Before getting to the results, it is important to note that the alternative explanations are being tested in an asymmetric way – from the perspective of the United States only – for this dependent variable. For example, only a measure of US FDI in its trade partners is considered rather than examining the extent of both US and trade partner FDI. Similarly, only US reliance on foreign inputs, not vice versa, is currently examined. Moreover, we might only expect these effects to be pronounced in US industries at a comparative disadvantage or parity with their foreign competitors. Unfortunately, gathering the necessary data is not currently possible and a complete set of interactions requires estimating a huge set of parameters. The next section, however, helps resolve some of these issues by focusing in on US industries at a comparative disadvantage that should, according to the usual approaches, op-

[14] 95% percent confidence intervals for these estimates are $(0.146, 0.626)$ and $(0.488, 0.934)$.

[15] When comparative advantage is in the trade partner's favor ($CA = .83$), the 95% CI for the increase in probability moving from homogeneity to moderate differentiation is $(-0.858, 0.452)$. Similarly, if the US is at a comparative advantage ($CA = 1.17$) the confidence interval for the change in probability of both industries having supporters is $(-0.421, 0.313)$. The equivalent confidence intervals moving to full differentiation from homogeneity are $(-0.123, 1.08)$ and $(0.155, 0.945)$.

Table 3.4: The linear probability models in this table consider the links between various predictors and bilateral support at the industry level. The interaction terms between comaparative advantage and product differentiation (lower order terms are estimated but omitted) show the predicted signs, but are not entirely robust to inclusion of the alternative predictors, which fare well in predicting bilateral support.

		Model 1		Model 2		Model 3		Model 4	
Variable	Exp. sign	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Intercept		-0.393	2.185	0.178	0.700	0.399	2.488	7.552	3.406
CA	0	0.009	0.035			0.004	0.038	-0.108^{*}	0.053
$(\text{CA})^2$	0	-0.000	0.000			-0.000	0.000	0.000^{*}	0.000
Mod. diff.*CA	+	0.387^{***}	0.130			0.384^{***}	0.131		
Mod. diff.*$(\text{CA})^2$	-	-0.002^{***}	0.001			-0.002^{***}	0.001		
Diff.*CA	+	0.605	0.657			0.536	0.657		
Diff.*$(\text{CA})^2$	-	-0.003	0.003			-0.003	0.003		
IIT*CA	+							0.642^{***}	0.161
IIT*$(\text{CA})^2$	-							-0.003^{***}	0.001
FDI	+			4.137^{**}	1.793	1.923	1.708	2.684	1.742
log(Sales)				0.007	0.031	-0.021	0.030	-0.000	0.030
Undiff. inputs	-			-0.043	0.031	-0.016	0.033	-0.079^{**}	0.035
Mod. diff inputs	+			0.054^{**}	0.024	0.026	0.022	0.044^{*}	0.023
Diff. inputs	+			0.069^{***}	0.016	0.038^{**}	0.015	0.055^{***}	0.015
Sample size		130		130		130		130	
F-test Comp		Intercept only		Intercept only		Model 2		Model 2	
F-test p-value		4.787e-10***		1.206e-06***		4.956e-05***		3.341e-03***	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$ from a two-tailed test with null hypothesis $\beta_j = 0$.

pose trade liberalization.

Returning to Model 3 in Table 3.4 note that the signs, sizes and standard errors of all coefficients in the model without these additional predictors are largely unchanged. As noted previously, under certain strict assumptions this suggests that the link between comparative advantage, product differentiation and support in both countries is not being driven by the extent of multinationalization or the reliance on foreign inputs in both industries.[16]

[16] The estimates using the causal mediation approach outlined in Imai et al. (2011) for the average direct effects, when comparative advantage is set to 1.02, are still significant. For example, the

These alternative explanations are of course of intrinsic interest on their own. First, consider FDI. In the previous section, no statistically significant (or even positive) association between FDI and the existence of intra-industry divisions over trade was documented. Here, the relationship between multinationalization and support in both countries is both significant and substantial. Using the results from Model 2, for example, an increase in the percentage of US FDI in the partner country from its 25th to its 75th percentile is estimated to increase the probability of support in both countries by $.108$ with 95% confidence interval $(0.025, 0.189)$.

As with the divisions outcome, the relationship between the input variables again fit Prediction 4 and are significant. The extent to which a US industry relies on undifferentiated inputs from the foreign trade partner is not associated with there being support in both countries. In contrast, the reliance on both moderately and fully differentiated inputs is associated with there being supporters in both countries. Again using the results from Model 2, an increase in the reliance of the industry on differentiated inputs from abroad is predicted to increase the probability of both industries supporting the agreement by $.101$ with 95% confidence interval $(.056, .144)$.

predicted increase in probability of divisions when going from a homogeneous to a differentiated good is 0.558 when the mediator treatment is set to differentiated and 0.600 when the mediator treatment is set to homogeneous. The respective confidence intervals are $(0.320, 0.812)$ and $(0.361, 0.820)$.

Alternative measures of product differentiation and comparative advantage

Appendix B again uses intra-industry trade between the US and its trade partners as a summary of product differentiation and comparative advantage. On its own the measure performs quite well, although the positive effect of intra-industry trade on both industries having a supporter is not robust to the inclusion of the alternative explanations.

Both alternative measures of product differentiation (the index of US intra-industry trade) perform extremely well as a substitute for the Rauch product differentiation measure. The US intra-industry trade index shows a statistically significant relationship in its interaction with comparative advantage, as shown in Model 4 of Table 3.4. The impact of moving from zero to a one on this intra-industry trade index is of very similar magnitude to the effects estimated in models 2 and 3. Similarly, the elasticity of substitution measure suggests a very strong and significant confirmation of Prediction 2 for both moderately and fully differentiated products, as shown in Appendix B.

As with the divisions outcome, the alternative measures of comparative advantage (with simulations presented in Appendix B) show a somewhat more ambiguous story. Product differentiation is again closely associated with support in both countries. However, this is most likely in comparative disadvantage countries when the product is moderately differentiated, and is seemingly unaffected by comparative advantage when the product is fully differentiated.

The data on bilateral support for KORUS and AUSUS in the same industry provide strong support for the role of product differentiation. The claim that industries at neither a strong comparative advantage nor disadvantage are most likely to be divided also finds some support, in particular using the preferred measure of comparative advantage developed here. These results are also quite robust to alternative measures of product differentiation but not robust to alternative measures of comparative advantage.

Support in comparative disadvantage industries

This section considers Prediction 3, which contends that industries at a comparative disadvantage should be more likely have an actor who supports trade liberalization if they are producing a differentiated product. This effect should also be present, if attenuated, among industries that are about as competitive as their foreign counterparts. Product differentiation is not predicted to have any effect on the probability of there being a supporter for industries which are at a comparative advantage. Figure 3.6 suggests that both of these claims are plausible. In particular, the proportion of industries with a supporter is sharply increasing with product differentiation among comparative disadvantage industries.

The main statistical results for this section are presented in Table 3.5. Note that a discretized version of the primary numerical measure of comparative advantage is used for this section. The results here are extremely sensitive to misclassification of neutral or comparative advantage industries into the comparative disadvantage bin because there are relatively few industries producing homogeneous products which are at a comparative disadvantage relative to producers in Australia and South Korea. The results are generally *not robust* to other measures of comparative

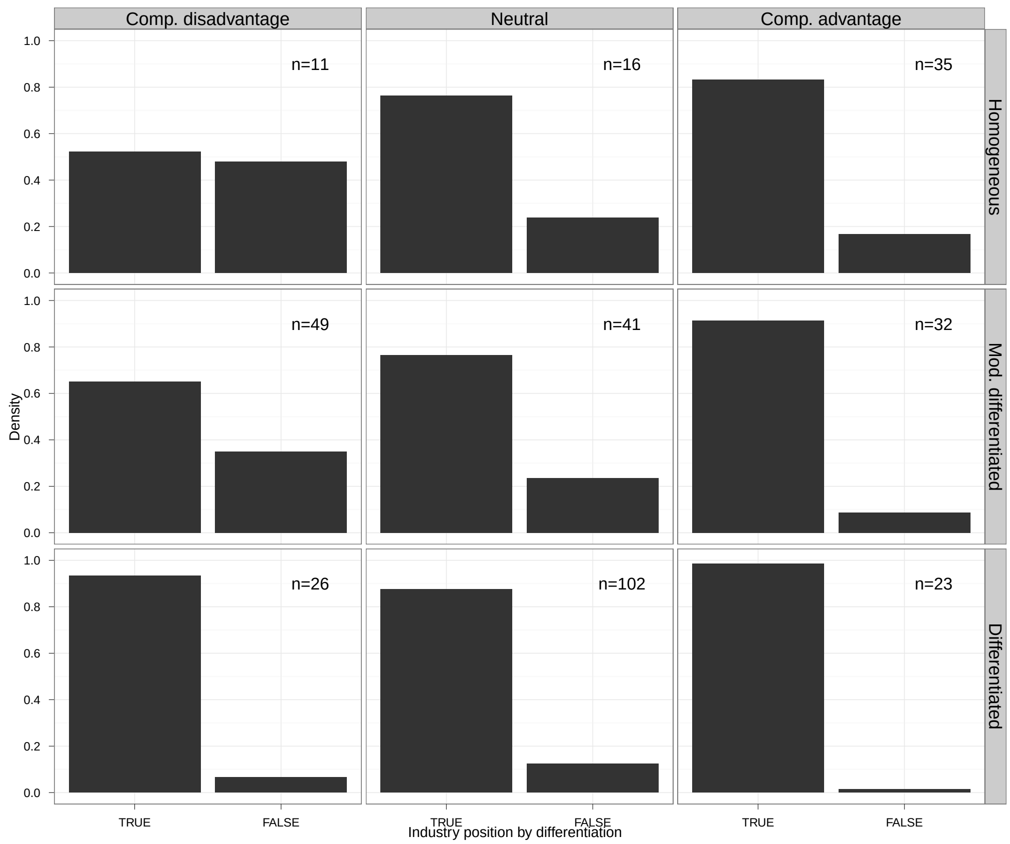

Figure 3.6: This figure presents the proportion of industries in the United States with a supportter of the two FTAs, by both comparative advantage and the extent of product differentiation. Note that in comparative disadvantage industries, the probability of seeing a supporter is noticeably higher as the product gets more differenitated. This effects is much weaker among neutral and comparative advantage industries.

advantage, and so should be approached accordingly.

The results using suggest that in industries at a comparative disadvantage, increasing product differentiation significantly increases the proportion of firms supporting trade liberalization. For example, the probability of a comparative disadvantage industry containing a supporter of trade liberalization increased by $.37$ and $.45$ moving from homogeneous good industries to moderately and fully differentiated good industries, respectively.[17] In contrast, for industries at a comparative advantage, the corresponding estimates are $.07$ and $-.01$. That is, increasing product differentiation has no discernable effect on whether or not there is a supportive actor.[18]

Alternative explanations

The alternative explanations are again partially supported as explanations for the existence of supporters. However, the estimates presented above for the interaction of comparative advantage and product differentiation remain similar. The coefficients on the moderate and full differentiation dummies are of particular interest because they represent the effect of increasing product differentiation in comparative disadvantage industries. These coefficients are somewhat reduced when

[17] The 95% confidence intervals for these estimates are $(-.137, .671)$ and $(-.046, .714)$ respectively, and so are not significant at the 95% level.

[18] Again, the 95% confidence intervals are $(-0.174, 0.221)$ and $(-0.188, 0.170)$ when considering the counterfactual of moving from a homogeneous good to both moderately and fully differentiated goods, respectively. For completeness, the equivalent counterfactuals for industries coded as 'neutral' are $(-0.051, 0.414)$ and $(-0.415, 0.288)$.

Table 3.5: Logistic regression models which use the existence of a supporter as an outcome for each industry. Models 1 amd 3 provide results which are consistent with Prediction 3, and suggest that these results are robust to the inclusion of alternative explanations. Nonetheless, Models 2 and 3 suggest that the alternative explanations, such as FDI and reliance on differentiated inputs, are viable explanations for support for trade liberalization. Model 4 considers an alternative measure of product differentiation which does not have the expected signs on the coefficients.

		Model 1		Model 2		Model 3		Model 4	
Variable	Exp. sign	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Intercept		-1.609	1.095	0.702	0.186	-1.773	1.122		
Mod. diff.	+	1.861	1.206			1.634	1.248		
Diff.	+	2.148^{*}	1.194			1.423	1.265		
Mod. diff.*Neutral	-	-1.028	1.336			-0.981	1.372		
Diff.*Neutral	-	-1.069	1.318			-0.955	1.364		
Mod. diff*Comp. ad.	-	-2.307^{*}	1.320			-2.182	1.348		
Diff.*Comp. ad.	-	-2.190^{*}	1.325			-2.329^{*}	1.364		
IIT	+							-0.874	1.383
IIT*Neutral	-							1.280	1.577
IIT*Comp. ad.	-							0.870	1.592
FDI	+			1.631	3.750	0.879	3.943	1.132	3.757
Undiff. inputs	0			-0.010	0.144	0.045	0.202	0.013	0.156
Mod. diff inputs	+			-0.130	0.092	-0.048	0.096	-0.025	0.099
Diff. inputs	+			0.499^{***}	0.156	0.571^{***}	0.184	0.503^{***}	0.165
Sample size		334		334		334		334	
LR Test Comp.		Intercept only		Intercept only		Mod 2		Mod 2	
LR Test p-value		0.012^{**}		0.001^{***}		0.038^{**}		0.049^{**}	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$ from a two-tailed test with null hypothesis $\beta_j = 0$.

the alternative explanations are included (and are not statistically significant) but they are of the right magnitude.[19]

Among the alternative explanations, the link between differentiated inputs and

[19] The estimated average direct effects, using the causal mediation approach when comparative advantage is set at ‘comparative disadvantage’ are also not significant. However, they are substantively large. For example, the predicted increase in probability of divisions when going from a homogeneous to a differentiated good is 0.265 when the mediator treatment is set to differentiated and 0.211 when the mediator treatment is set to homogeneous. The respective confidence intervals are $(-0.178, 0.698)$ and $(-0.201, 0.667)$.

support again fares the best in finding a robust association with the existence of supporters of these FTAs. Increasing the reliance on differentiated inputs from its 25th to its 75th percentile, while holding all other predictors from Model 2 at their median, is estimated to increase the probability of an industry having a supporter by 0.125. The 95% confidence interval for this estimate is $(0.054, 0.210)$. The FDI variable has a sign that is consonant with theoretical expectations, but is not significant.

Alternative measures of product differentiation and comparative advantage

Appendix B uses the extent of intra-industry trade between the two countries, but only in industries that are neutral or comparative disadvantage. The impact of intra-industry trade is as expected, although generally not statistically significant. The effect is also much reduced when the other explanations for support in comparative disadvantage industries are included.

Model 4 of Table 3.5 also examines an alternative measure of product differentiation, as above. Prediction 3 is not supported using the Grubel-Lloyd index for all trade between the US and the world as a measure of product differentiation, and the signs of the coefficients are in fact opposite to expectations. The elasticity-based measure of product differentiation performs much better and the coefficients are signed in the right direction and of substantial magnitude, though generally not significant.

Using relative exports and relative revealed comparative advantage as measures of comparative advantage provide quite good support for Prediction 3. Industries producing homogeneous goods, and at a comparative disadvantage, feature far fewer supporters of trade liberalization.

Conclusion

This chapter presents and tests several theories of the preferences of industries, and the actors that constitute them, over trade liberalization. On the theoretical side, three arguments are of particular importance. First, the chapter builds on the previous chapter in elucidating a clear and testable set of conditions under which industries are likely to be internally divided over trade liberalization because of firm heterogeneity in export performance. These are that the industry should not be too (un)competitive relative to its foreign trade partners and that the product should be differentiated. The paper therefore builds off of the new, new trade theory in developing and testing a theory of where distributive effects within industries are likely to lead to intra-industry divisions over trade. Put another way, it brackets the microfoundations of trade politics with heterogeneous firms, which considers which firms support trade liberalization in a particular industry, and focuses on a macro implication of this theory: only some industries have the right mix of ingredients to generate divisions over trade.

Second, the paper considers in depth the role of foreign direct investment in generating divisions over trade liberalization. Industries with primarily horizontal FDI are identified as unlikely sites for these divisions because divisions rely, in theory, on a clash between non-exporting (but highly productive) producers in the foreign market and exporters in the home market (the latter of which are likely to be few in number, because horizontal FDI is generally driven by high barriers to trade). FDI of the vertical type is a more plausible explanation for divisions but is present under a different set of conditions then the divisions predicted by the new, new trade theory. In particular, it is predicted where factor prices are sharply different and so comparative disadvantages are present. This helps to distinguish between an FDI-based story of divisions and the distributive consequences emphasized in the literature on heterogeneous firms.

Third, the paper develops an argument about the role of product differentiation in the import of foreign inputs. While variation in the extent of importing inputs among firms has long been argued to be a cause of intra-industry divisions, it is argued here that this should only be so if inputs are differentiated. Homogeneous inputs have a single market price and so all firms benefit equally when their price falls due to greater imports. Differentiated inputs are firm-specific and their benefits are more excludable. While all firms may benefit in principle from an increase in competition in the input sector, those firms which source from abroad may be best able to take advantage of new opportunities and use their now superior inputs to lower prices and increase sales, pushing firms with fewer foreign linkages out of business.

Both of these alternative explanations (that is, both FDI and reliance on foreign inputs) are areas which require both further theoretical and empirical work. On the theoretical side, the distributive consequences of trade liberalization are developed here only informally and require a complete formal treatment to be fully explored. On the empirical side, the measure of FDI used here is at a quite high level of aggregation and does not distinguish between vertical and horizontal FDI.

The chapter's empirical contributions can be summarized in three points. First, three empirical implications of the new, new trade theory are derived. Product differentiation is linked to intra-industry divisions, support for bilateral trade liberalization in both countries within a single industry, and support for trade liberalization in comparative disadvantage industries. Each of these is surprising from the perspective of standard approaches to trade politics, and so merits attention to the extent it is present in the data. A new data set is collected to test each of these predictions, based on the public statements of US trade associations and firms, as well as matching data from Korean and Australian trade associations. Although the latter data are generally less rich, they are sufficient to provide some initial tests of the hypotheses. However, owing to the demanding nature of the theory being tested here, which requires considerable variation in comparative advantage across different levels of product differentiation to estimate non-linear regression functions, there is clearly a need for more data to provide the most convincing test of these arguments.

Second, the paper finds strong evidence for the contention that product differentiation is associated with each of the 'surprises' described above. There is also some evidence that these are most likely where comparative disadvantages are muted, although it is generally not as strong. In particular, intra-industry divisions are also likely in US industries at a comparative disadvantage, as long as the product is differentiated. These patterns are generally robust, in parametric statistical models, to the inclusion of the post-treatment alternative explanations described above.

Finally, the paper also examines the impact of FDI and the extent of reliance on imported inputs on intra-industry divisions. Moderately and fully differentiated inputs are fairly consistent predictors of the three surprises, while the extent of reliance on homogeneous inputs adds little as a predictor. FDI is only inconsistently associated with the three surprises.

Which industries are divided over bilateral trade liberalization? Schattschneider (1935) provided several explanations for divisions over unilateral liberalization in his seminal study of trade politics in America. The new, new trade theory suggests an extra explanation for these divisions, rooted in firm heterogeneity, when trade liberalization is bilateral or multilateral. It is argued here that these divisions rely crucially on two industry features: product differentiation and muted comparative (dis)advantages relative to their trade partners. These factors help explain the intra-industry divisions over trade which arose in the debates over AUSUS and KORUS, as well as two additional surprising features in patterns of support and opposition: many industries featured supporters of liberalization in both trade partners; and, many comparative disadvantage industries had supporters of these agreements.

Appendix A: Imputed positions

Several US industries received imputed positions for the KORUS agreement. Other vegetables (111219) was coded as favoring, although its associations were in fact divided once the CSUSTL petition is taken into account. However, the opposing groups were all Florida-based, and they appeared to team up in opposition because South Korea was permitted to maintain some significant seasonal tariffs on oranges. The US apiculture industry (112910) took no position, but is an imputed supporter. Apiculture products were largely exempted from tariff reductions on the part of South Korea. The rice milling industry opposed the agreement but is imputed as favoring the agreement, because South Korea was permitted to maintain very stringent limits on US rice imports. Finally, the footwear industry, which favored the agreement, was imputed as 'divided' because 17 specific footwear types were exempted from tariff reductions. No positions were imputed for Korean industries. No US or Australian industry positions were imputed for positions on the US-Australia Free Trade Agreement.

Appendix B: Robustness Checks

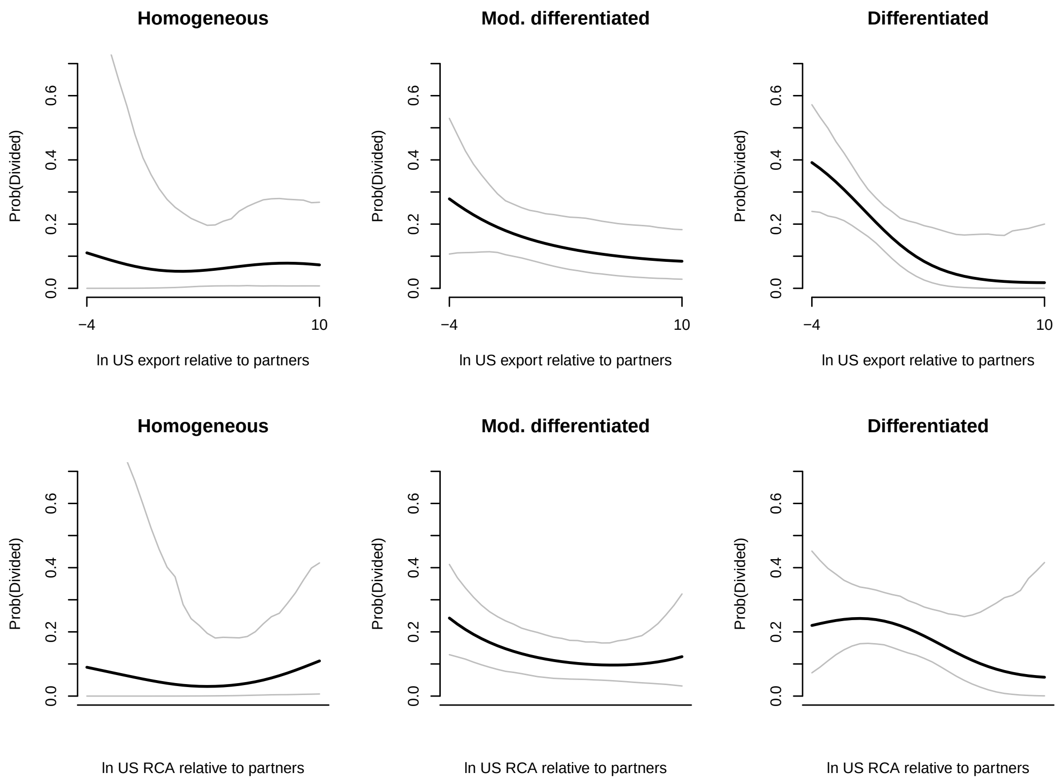

Figure 3.7: Predicted probabilities of intra-industry divisions are plotted here from a logit regression using a dichotomous indicator for divisions. The predictors are the Rauch measure of product differentiation and two proxies for comparative advantage: the logged ratio of US exports to imports for either South Korea or Australia; and, the logged ratio of Balassa's revealed comparative advantage measure. The plots suggest that intra-industry divisions are most likely where products are differentiated and the US is at a comparative disadvantage. However, the differences among the treatments are generally not statistically significant.

Table 3.6: Regression results considering the links between intra-industry trade between the US and its two trade parterns in the FTAs under consideration. Each regression is a logistic regression where a 1 indicates that the industry was internally divided over the agreement. The results suggest a positive correlation between the extent of intra-industry trade and probability of divisions.

		Model 1		Model 2		Model 3		Model 4	
Outcome:	Variable	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Divided	Intercept	-2.024	0.237	-3.332	0.720	-2.447	0.347	-8.111	3.084
	$\text{IIT}_{\text{US,Partner}}$	0.697	0.490						
	$\text{I}(\text{IIT}_{\text{US,Pa}} > 0)$			1.718^{*}	0.738			$1.402^{\cdot}$	0.757
	$\text{I}(\text{IIT}_{\text{US,Pa}} > .05)$					0.901^{*}	0.390		
	FDI							-9.189	7.577
	log(Sales)							0.215	0.134
	Undiff. inputs							-0.285	0.930
	Mod. diff inputs							0.206^{*}	0.105
	Diff. inputs							0.105	0.072
	Sample size	335		335		335		335	
	LRT Comp	Intercept only		Intercept only		Intercept only		Model 1	
	LRT p-value	0.158		0.003^{*}		0.013^{*}		$0.070^{\cdot}$	
Both happy	Intercept	0.002	0.250	-1.030	0.521	-0.383	0.335	-6.456	4.255
	$\text{IIT}_{\text{US,Partner}}$	0.606	0.593						
	$\text{I}(\text{IIT}_{\text{US,Pa}} > 0)$			1.413^{*}	0.556			-0.051	0.702
	$\text{I}(\text{IIT}_{\text{US,Pa}} > .05)$					0.797^{*}	0.396		
	FDI							15.154	12.210
	log(Sales)							0.210	0.186
	Undiff. inputs							-4.356	8.141
	Mod. diff inputs							0.321	0.203
	Diff. inputs							1.510^{*}	0.362
	Sample size	130		130		130		130	
	LRT Comp	Intercept only		Intercept only		Intercept only		Model 1	
	LRT p-value	0.303		6.794e-03*		0.042^{*}		3.595e-12*	
Some happy	Intercept	0.750	0.244	0.452	0.483	0.523	0.315	-6.359	3.006
	$\text{IIT}_{\text{US,Partner}}$	0.738	0.516						
	$\text{I}(\text{IIT}_{\text{US,Pa}} > 0)$			0.640	0.511			0.133	0.563
	$\text{I}(\text{IIT}_{\text{US,Pa}} > .05)$					$0.657^{\cdot}$	0.365		
	FDI							6.280	6.712
	log(Sales)							0.296^{*}	0.135
	Undiff. inputs							$-5.709^{\cdot}$	2.944
	Mod. diff inputs							-0.062	0.104
	Diff. inputs							0.665^{*}	0.219
	Sample size	209		209		209		209	
	LRT Comp	Intercept only		Intercept only		Intercept only		Model 1	
	LRT p-value	0.148		0.222		$0.076^{\cdot}$		1.732e-05*	

$^{*}p < 0.05, ^{\cdot}p < 0.1$ from a two-tailed test with null hypothesis $\beta_j = 0$.

Table 3.7: Using a trichotomoized version of the elasticity of substitution as a measure of product differentiation. The measure of comparative advantage in models 3 and 4 is the log of US exports to the trade partner divided by trade partner exports to the US.

			Mod 1		Mod 2		Mod 3		Mod 4	
Outcome:	Variable	Exp.	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Divisions	CA	0	-0.030	0.028	-0.030	0.028				
	CA^2	0	0.000	0.000	0.000	0.000				
	Mod. diff.*CA	+	0.088	0.058	0.066	0.058				
	Mod. diff.*CA^2	-	-0.000	0.000	-0.000	0.000				
	Diff.*CA	+	0.002	0.034	-0.000	0.033				
	Diff.*CA^2	-	0.000	0.000	0.000	0.000				
	RE	0					-0.065^{***}	0.019	-0.065^{***}	0.019
	RE^2	0					0.003^{**}	0.001	0.003^{**}	0.001
	Mod. diff.*RE	+					0.038	0.024	0.048^{*}	0.024
	Mod. diff.*RE^2	-					-0.002	0.002	-0.002	0.002
	Diff.*RE	+					0.053^{**}	0.020	0.051^{**}	0.020
	Diff.*RE^2	-					-0.003^{**}	0.001	-0.002^{*}	0.001
	FDI	+			-0.424	0.493			-0.898	0.503
	Undiff. inputs	0			-0.008	0.024			-0.008	0.023
	Mod. diff inputs	+			0.042^{***}	0.015			0.029^{*}	0.015
	Diff. inputs	+			0.021^{**}	0.010			0.017^{*}	0.010
Both happy	CA	0	-0.009	0.040	-0.004	0.038				
	CA^2	0	0.000	0.000	-0.000	0.000				
	Mod. diff.*CA	+	0.440^{***}	0.158	0.357^{**}	0.152				
	Mod. diff.*CA^2	-	-0.002^{***}	0.001	-0.002^{**}	0.001				
	Diff.*CA	+	0.814^{***}	0.218	0.587^{**}	0.232				
	Diff.*CA^2	-	-0.004^{***}	0.001	-0.003^{**}	0.001				
	RE	+					-0.050	0.033	-0.046	0.030
	RE^2	-					0.003	0.002	0.003	0.002
	Mod. diff.*RE	+					0.000	0.048	0.003	0.046
	Mod. diff.*RE^2	-					-0.001	0.003	-0.001	0.003
	Diff.*RE	+					0.048	0.038	0.046	0.036
	Diff.*RE^2	-					-0.006^{**}	0.003	-0.004^{*}	0.003
	FDI	+			2.405	1.714			3.009^{*}	1.762
	Undiff. inputs	0			-0.012	0.035			-0.053^{*}	0.031
	Mod. diff inputs	+			0.036	0.024			0.030	0.025
	Diff. inputs	+			0.054^{***}	0.016			0.057^{***}	0.017
Some happy	Mod. diff	+	0.187	0.235	0.177	0.235	0.072	0.089	0.065	0.089
	Diff.	+	0.417^{*}	0.229	0.362	0.228	0.022	0.080	-0.010	0.080
	Mod. diff.*CA	-	-0.003	0.256	-0.017	0.256				
	Mod. diff.*CA^2	-	-0.242	0.263	-0.226	0.263				
	Diff.*CA	-	-0.411^{*}	0.247	-0.378	0.245				
	Diff.*CA^2	-	-0.536^{**}	0.250	-0.516^{**}	0.248				
	Mod. diff.*RE	+					0.024	0.031	0.027	0.031
	Mod. diff.*RE^2	-					-0.002	0.002	-0.002	0.002
	Diff.*RE	+					0.016	0.026	0.014	0.025
	Diff.*RE^2	-					-0.002	0.002	-0.001	0.002
	FDI	+			-0.017	0.603			0.657	0.628
	Undiff. inputs	0			0.004	0.029			-0.006	0.029
	Mod. diff inputs	+			-0.004	0.019			-0.012	0.019
	Diff. inputs	+			0.038^{***}	0.012			0.044^{***}	0.012

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$ from a two-tailed test with null hypothesis $\beta_j = 0$.

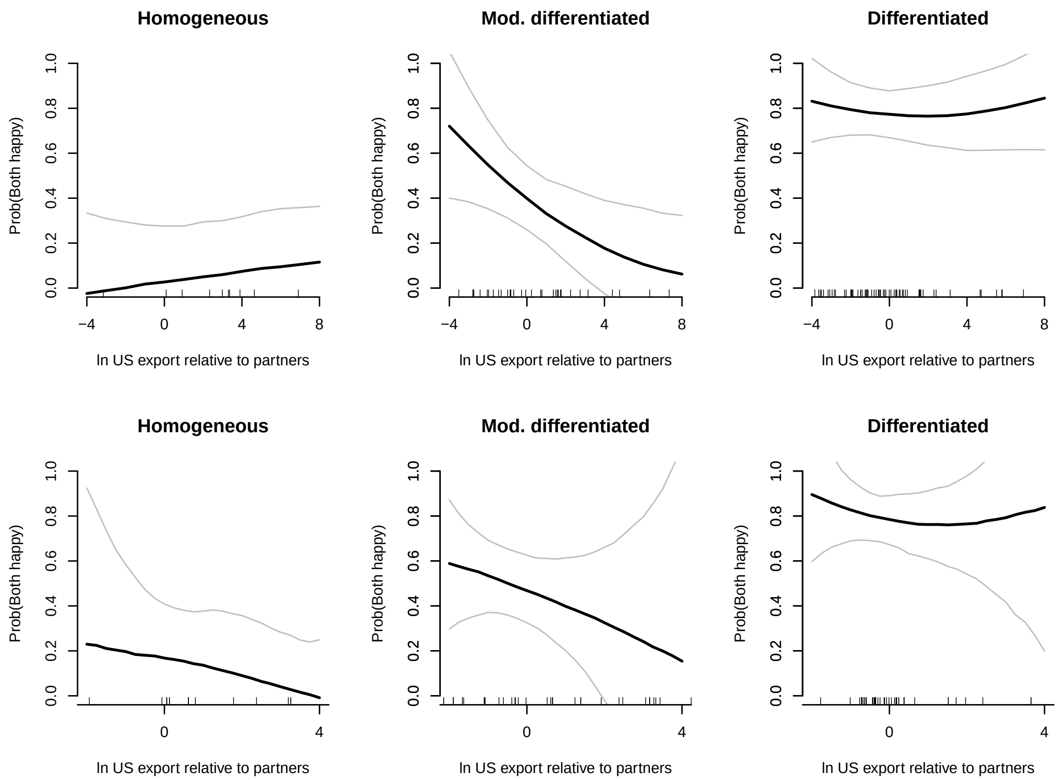

Figure 3.8: Predicted probabilities of both industries, foreign and domestic, supporting the FTA from a logit regression. As above, the predictors are the Rauch measure of product differentiation and two proxies for comparative advantage: the logged ratio of US exports to imports for either South Korea or Australia; and, the logged ratio of Balassa's revealed comparative advantage measure. The plots suggest that both industries supporting the agreements is most likely where products are differentiated and the US is at a comparative disadvantage.

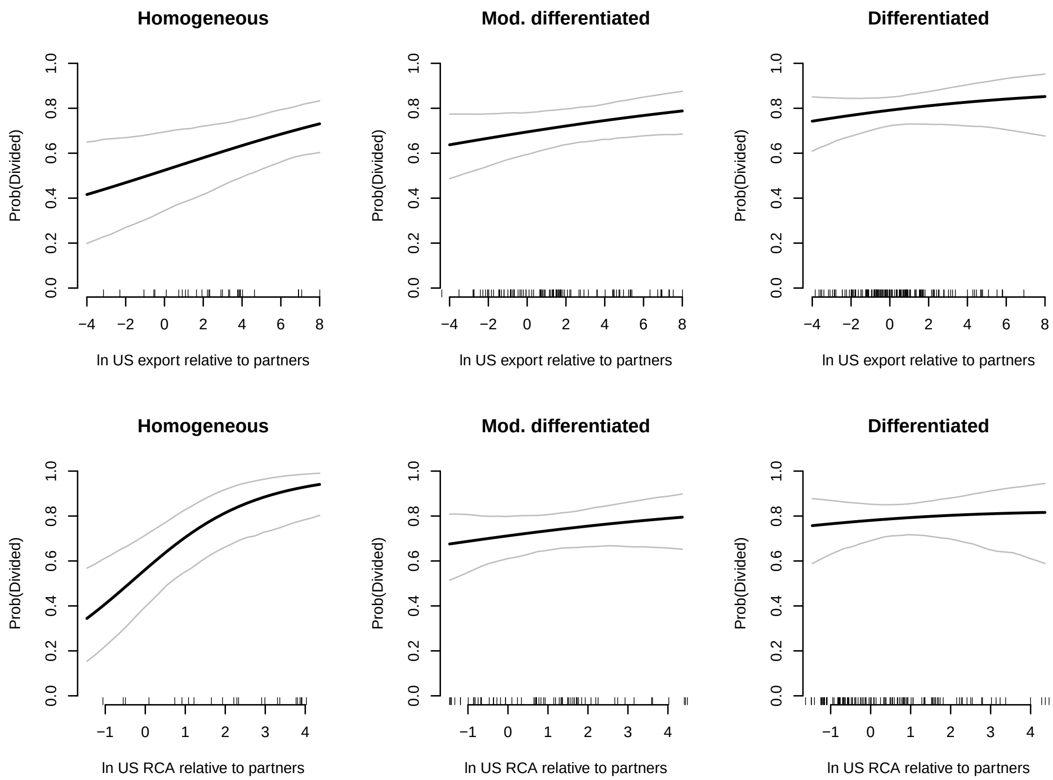

Figure 3.9: Predicted probabilities of existence of support for the two FTAs from a logistic regression. As above, the predictors are the Rauch measure of product differentiation and two proxies for comparative advantage: the logged ratio of US exports to imports for either South Korea or Australia; and, the logged ratio of Balassa's revealed comparative advantage measure. The plots suggest that comparative disadvantage industries support trade liberalization only when the product is differentiated.

Table 3.8: Replication of baseline models with each dependant variable using standard errors clustered at the four- and three-digit NAICS levels (for each country). For the divisions and 'both happy' outcome, patterns of significance are largely unchanged. For the 'some happy' outcome, several of the dichotomous predictors lose significance

			Mod 1		Mod 2		Mod 3		Mod 4	
	SE Clustering		4-digit NAICS		3-digit NAICS		4-digit NAICS		3-digit NAICS	
Outcome:	Variable	Exp.	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Divisions	Intercept		8.964	4.611	8.964	3.921	9.229	4.751	9.229	4.066
	CA	0	−0.232***	0.072	−0.232***	0.056	−0.236***	0.073	−0.236***	0.058
	$(CA)^2$	0	0.001***	0.000	0.001***	0.000	0.001***	0.000	0.001***	0.000
	Mod.*CA	+	1.642	1.147	1.642	1.236	1.818	1.173	1.818	1.261
	Mod.*$(CA)^2$	-	−0.007	0.006	−0.007	0.006	−0.008	0.006	−0.008	0.006
	Diff.*CA	+	12.766**	6.158	12.766**	6.099	14.856**	7.239	14.856**	6.942
	Diff.*$(CA)^2$	-	−0.064**	0.031	−0.064**	0.030	−0.075**	0.036	−0.075**	0.035
	FDI	+					−4.357	9.728	−4.357	10.496
	Undiff. inputs	0					−0.188	0.445	−0.188	0.547
	Mod. inputs	+					0.168*	0.101	0.168	0.122
	Diff. inputs	+					0.172*	0.092	0.172*	0.103
	Sample size		334		334		334		334	
Both happy	Intercept		−0.393	0.812	−0.393	0.800	−0.041	0.972	−0.041	0.600
	CA	0	0.009	0.013	0.009	0.014	0.003	0.015	0.003	0.011
	$(CA)^2$	0	−0.000	0.000	−0.000	0.000	−0.000	0.000	−0.000	0.000
	Mod. diff.*CA	+	0.387**	0.153	0.387**	0.159	0.365***	0.141	0.365**	0.155
	Mod. diff.*$(CA)^2$	-	−0.002**	0.001	−0.002**	0.001	−0.002**	0.001	−0.002**	0.001
	Diff.*CA	+	0.605	0.845	0.605	0.879	0.513	0.845	0.513	0.837
	Diff.*$(CA)^2$	-	−0.003	0.004	−0.003	0.004	−0.003	0.004	−0.003	0.004
	FDI	+					1.622	1.459	1.622	1.586
	Undiff. inputs	0					−0.015	0.011	−0.015*	0.009
	Mod. diff inputs	+					0.027	0.019	0.027*	0.015
	Diff. inputs	+					0.039**	0.015	0.039*	0.020
	Sample size		130		130		130		130	
Some happy	Intercept		−1.609	1.131	−1.609	1.131	−1.773	1.114	−1.773	1.144
	Mod. diff.	+	1.861	1.347	1.861	1.341	1.634	1.353	1.634	1.308
	Diff.	+	2.148	1.352	2.148	1.373	1.423	1.380	1.423	1.330
	Mod.*Neut.	-	−1.028	1.450	−1.028	1.471	−0.981	1.464	−0.981	1.496
	Mod.*CA	-	−2.307	1.521	−2.307*	1.266	−2.182	1.504	−2.182*	1.231
	Diff.*Neut.	-	−1.069	1.486	−1.069	1.501	−0.955	1.497	−0.955	1.502
	Diff.*CA	-	−2.190	1.479	−2.190**	1.112	−2.329	1.450	−2.329**	1.043
	FDI	+					0.879	6.042	0.879	6.195
	Undiff. inputs	0					0.045	0.085	0.045	0.089
	Mod. inputs	+					−0.048	0.112	−0.048	0.122
	Diff. inputs	+					0.571***	0.201	0.571**	0.274
	Sample size		335		335		335		335	

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Heteroskedasticity-robust and clustered standard errors.

Table 3.9: Random effects models estimated to handle cluser-specific intercepts at the three- and four-digit NAICS level. All of the variables maintain their sign, and most retain their significance. The major exception are the 'some happy' models when random effects at the four-digit level are estimated.

	Random effects		Mod 1 4-digit NAICS		Mod 2 3-digit NAICS		Mod 3 4-digit NAICS		Mod 4 3-digit NAICS	
Outcome:	Variable	Exp.	Coef	SE	Coef	SE	Coef	SE	Coef	SE
Divisions	Intercept		-36.786	131.515	12.938	16.204	-0.747	44.139	8.602	17.326
	CA	0	0.344	2.132	-0.304	0.261	-0.243	0.709	-0.357	0.279
	$(CA)^2$	0	-0.001	0.008	0.001	0.001	0.001	0.003	0.001	0.001
	Mod.*CA	+	0.727	3.104	1.392	1.200	1.457	1.954	1.323	1.256
	Mod.*$(CA)^2$	-	-0.003	0.013	-0.006	0.006	-0.006	0.009	-0.006	0.006
	Diff.*CA	+	11.154	8.878	12.359^{**}	5.321	14.235^{*}	7.367	14.331^{**}	5.635
	Diff.*$(CA)^2$	-	-0.056	0.044	-0.062^{**}	0.027	-0.072^{*}	0.037	-0.072^{**}	0.028
	FDI	+					-24.057	26.478	-0.568	7.937
	log Sales						0.346	0.245	0.338^{**}	0.165
	Undiff. inputs	0					-0.278	3.335	-0.079	0.997
	Mod. inputs	+					0.324^{*}	0.190	0.154	0.125
	Diff. inputs	+					0.361^{**}	0.165	0.216^{*}	0.119
	Sample size		334		334		334		334	
Both happy	Intercept		-1.667	1.838	-1.503	1.674	-1.430	2.035	-2.384	1.866
	CA	0	0.028	0.029	0.030	0.027	0.028	0.030	0.041	0.029
	$(CA)^2$	0	-0.000	0.000	-0.000	0.000	-0.000	0.000	-0.000	0.000
	Mod.*CA	+	0.152	0.122	0.139	0.104	0.169	0.125	0.110	0.109
	Mod.*$(CA)^2$	-	-0.001	0.001	-0.001	0.000	-0.001	0.001	-0.001	0.001
	Diff.*CA	+	0.678	0.578	0.733	0.547	0.696	0.590	0.609	0.548
	Diff.*$(CA)^2$	-	-0.003	0.003	-0.004	0.003	-0.003	0.003	-0.003	0.003
	FDI	+					2.028	2.328	3.391^{**}	1.772
	log Sales						-0.014	0.025	-0.001	0.025
	Undiff. inputs	0					-0.001	0.033	0.020	0.028
	Mod. inputs	+					0.032	0.026	0.013	0.023
	Diff. inputs	+					0.019	0.013	0.027^{**}	0.014
	Sample size		130		130		130		130	
Some happy	Intercept		-2.439	1.859	-1.035	1.322	-8.741	4.917	-6.470	3.491
	Mod. diff.	+	4.778^{**}	2.102	1.905	1.436	4.844^{**}	2.209	2.125	1.534
	Diff.	+	4.254^{**}	2.164	1.575	1.501	4.221^{*}	2.407	1.594	1.598
	Mod.*Neut.	-	-4.008^{*}	2.215	-1.354	1.537	-4.454^{*}	2.307	-1.671	1.634
	Mod.*CA	-	-5.526^{**}	2.269	-2.632^{*}	1.556	-5.624^{**}	2.367	-2.618	1.649
	Diff.*Neut.	-	-2.928	2.299	-0.934	1.586	-3.262	2.502	-1.047	1.687
	Diff.*CA	-	-3.876	2.366	-2.202	1.608	-4.478^{*}	2.596	-2.353	1.730
	FDI	+					3.992	14.445	9.081	9.024
	log Sales						0.264	0.206	0.198	0.144
	Undiff. inputs	0					0.060	0.444	0.267	0.329
	Mod. inputs	+					-0.323	0.209	-0.073	0.140
	Diff. inputs	+					1.021^{**}	0.421	0.808^{***}	0.308
	Sample size		335		335		335		335	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$ from a two-tailed test with null hypothesis $\beta_j = 0$.

Chapter 4

Determining Trade Policy with Divided Industries

Introduction

This chapter develops a complete political economic model of trade policy determination using an economic model of firm heterogeneity in export performance. It contributes to a growing literature on the political implications of the 'new, new' trade theory, which explores variation in exporting at the firm level. It also reaches back to an earlier literature on the politics of liberalization with intra-industry trade. Several of the results highlight the ways in which bilateral trade flows in the same industry alter the dynamics of trade policymaking. Together, these two additions provide new insights into the forces shaping trade policy and help explain variation in levels of protection across industries and between countries.

The chapter begins with the simplest possible setting: a government unilaterally sets trade barriers with no redistributed tariff revenue, no foreign lobbying and no trade in intermediate inputs. Under these conditions, there are no interior solutions. The rest of the paper examines settings in which interior solutions are possible, and develops comparisons with this baseline case.

When foreign firms are permitted to lobby, or there are multinational firms, tariffs are lower than they would be if these firms are not permitted to lobby. However, the same is not necessarily true of non-tariff barriers. It is shown that under certain conditions exporters can actually benefit in the aggregate from a small positive level of non-tariff barriers in their export market. This occurs if exporting firms are much more competitive than the domestic firms in their export market. The explanation for this result is that highly productive exporters can gain from trade barriers that restrict entry of other competitors in the export market, even if its raises their own costs of exporting. This is an 'optimal trade barrier' argument for firms.

The redistribution of tariff revenue tends to 'pull in' equilibrium tariffs from the extremes of the baseline case. In situations that would be autarkic in the baseline case, distributing tariff revenue to consumers gives them an extra incentive to push for lower tariffs. In other words, they are motivated to consume more and to be given more public goods funded by tariff revenues. In situations where tariffs would otherwise be zero, the same intuition is also true. Consumers benefit from a slight increase in tariffs which gives them new revenue and forces foreign firms to lower their prices. This is an instance of the optimal tariff argument for consumers.

The second half of the chapter shows that trade barriers are generally lower in internationally negotiated trade agreements than in settings where tariffs are unilaterally determined. I also argue that intra-industry trade provides a theoretic rationale for trade agreements in a single industry. When both countries export while protecting their domestic markets, both country's exporters are hurt. Put another way, trade barriers are an externality and intra-industry trade means that both sides may be left worse off with their application. Trade negotiations can resolve this cooperative dilemma.

The chapter also develops a series of comparative statics, mainly focusing on competitiveness of the firms, the extent of product differentiation in the industries, and on the extent to which governments weight different interest groups in their objective function. These are not easily summarized, except for one. Trade barriers are generally decreasing in product differentiation, because consumers demand access to more varieties and each firm gains less from trade protection as love-of-variety increases.

The economic model which underlies all of the results in the chapter was first developed in Melitz and Ottaviano (2008). This chapter also makes use of a slight variant of the model, which involves use of a tariff rather than a variable cost-of-trade. The economic model combines firm heterogeneity in exporting (which is generated by exogenous variation in a constant marginal cost of production) with intra-industry trade (generated by an intrinsic consumer love-of-variety). To my knowledge, this is the first paper to use the Melitz and Ottaviano (2008) model in an endogenous tariff setting.

The final section of the chapter describes in some detail the contribution of the chapter, but this can be outlined here in several points. First, product differentiation and intra-industry trade fundamentally alter the politics of trade policy. At the most basic level, intra-industry trade means that both countries simultaneously engage in protection *in the same industry*. This rationalizes the widespread existence of trade barriers in the same industries, which cannot be explained in a model with homogeneous products. Intra-industry trade also provides justification for trade negotiations *over a single industry*, as noted above.

The starting point of the endogenous tariff literature is that import-competing industries desire greater protection, and consumers generally want free trade. The approach here suggests a more complex web of interests. Productive home market producers will sacrifice protection at home to gain tariff reductions abroad, harming smaller non-exporters in the process. Consumers may favor optimal tariff increases that productive producers oppose if they will lead to a trade war. Most strangely, highly productive producers may benefit from a small level of non-tariff barriers in their export market. Their interests therefore conflict with less-productive exporters. Firm heterogeneity is lurking behind each of these conflicts.

Governments lie at the intersection of these competing interests. Understanding who governments represent, and whose interests are downplayed or ignored is therefore of fundamental importance. Institutional and economic features also interact in determining equilibrium trade barriers, sometimes in unpredictable ways. Governments which value consumer interests highly will usually set lower trade barriers, unless consumers benefit from an optimal tariff. If foreign firms are permitted to lobby, tariff barriers are lower but non-tariff barriers might be higher. When countries jointly negotiate their trade policies, trade barriers are lower than they would be if policy is made unilaterally, unless one country's most productive firms actually desire higher NTBs. A key part of the analysis will therefore be establishing the circumstances under which each result obtains.

Finally, the comparative statics help explain which industries will be protected and when. As noted above, trade barriers are generally decreasing in consumer love-of-variety, the key driver of intra-industry trade. This helps explain why barriers to trade are generally much higher in commodity products than in more differentiated manufactures. The relationship between the comparative advantage of domestic producers and levels of protection depend strongly on whether tariff or non-tariff barriers are employed and on the circumstances of bilateral negotiations. In the simplest unilateral settings, though, trade barriers are increasing in the competitiveness of domestic firms. Trade protection therefore serves to enrich the strongest industries, rather than defend the weakest.

Existing literature

This chapter joins a number of others which have taken up the politics of trade policy in models of firm heterogeneity. In this vein, it is most directly similar to Chang and Willmann (2006), Abel-Koch (2010), and Ossa (2010), each of which use the constant elasticity of substitution utility function employed in Melitz (2003). Abel-Koch (2010) focuses primarily on the contrasting cases of fixed costs of trade imposed at the border versus general costs of production applicable to all firms, domestic and foreign. As noted above, Ossa (2010) is focused on establishing a new justification for cooperative negotiations on reductions in trade barriers. This chapter develops a similar theme in the section on trade negotiations, although the mechanism explored turns out to be quite different.

A second strand of this literature, exemplified by Demidova and Rodríguez-Clare (2009), Cole and Davies (2011), Felbermayr, Jung and Larch (2011) and Felbermayr and Jung (2012), explore the question of optimal tariffs, from the perspective of cosumers, in models with firm heterogeneity. This chapter takes up this issue, too, finding that a positive tariff is welfare maximizing for consumers under all circumstances. At some level, it is not surprising that a small positive tariff can be welfare maximizing when firms monopolize the production of a particular good or variety and therefore have some pricing power (Brander and Spencer, 1984; Helpman, 1990). On the other hand, product differentiation and firm heterogeneity unlock new gains from trade, such as the increase in varieties and improvements in the productivity of firms, so it cannot be taken for granted that an optimal tariff argument will apply. To my knowledge, this is the first attempt to develop an optimal tariff argument within the short-run version of the Melitz and Ottaviano (2008) model.

A separate focus in this rapidly developing literature takes up the issue of lobbying by firms. Bombardini (2008) examines how the distribution of firm sizes affects the ability of an industry to organize for, and secure, trade protection. A more skewed distribution of firm sizes makes it easier to overcome the collective action problem due to the existence of large firms whose contribution to the lobbying effort can be decisive. Bombardini and Trebbi (2012) looks at the tradeoffs for firms deciding between collective ('public') or variety-specific ('private') protection, finding that sectors with differentiated products tend to lobby as firms rather than through trade associations. The perspective of this chapter is different, assuming that trade policy is a public good under all circumstances. This chapter is also silent on the process of by which lobbies are formed, assuming rather than explaining their existence. Clearly, this is a rich area for further research in the vein of the two papers described above.

Outline

The structure of the chapter is as follows. All of these claims are developed in a model of international trade with firm heterogeneity in export performance first developed in Melitz and Ottaviano (2008). The crucial features of this model are explained in the first section, and then all of the aggregates which will compose the government's objective function are derived. Understanding these aggregates is crucial for identifying the model's comparative statics, so a number of lemmas are presented which explain how changes in trade barriers effect producers, consumers and tariff revenue. The next section also introduces the political economy set-up which adopts the "political support function" approach: governments maximize a weighted sum of producer and consumer utility (Helpman, 1997).

The core results of the model are then presented, investigating first non-cooperative and then cooperative settings. In this model, a baseline political equilibrium where all tariff or trade barriers are deadweight loss leads to no interior solutions. The economy is fully open or closed. The rest of the chapter develops four different settings in which interior solutions are possible. In non-cooperative settings where tariff revenue is redistributed or foreign firms are capable of lobbying (or multinationals are assumed to exist) interior solutions are possible, and in the former case, highly probable. The inclusion of foreign-based firms in the governments' objective function usually lowers the equilibrium level of trade barriers although there are some important exceptions to this rule – when foreign competitors are preponderant in size and productivity relative to producers located in the home market – which are described below. Redistribution of tariff revenue can serve to raise or lower tariffs relative to the case where all tariff revenue is lost, and it is proven that when tariff revenue is distributed to consumers, they prefer a small, positive tariff to free trade despite the higher prices and loss in product variety.

In cooperative settings, both with and without international transfers available to grease the skids of mutual reductions in trade barriers, restrictions on trade are generally lower then in non-cooperative settings. The sources of gains from negotiations for the two countries are also discussed.

The Model

The first part of this section introduces the model of the economy, which was first developed in Melitz and Ottaviano (2008). The results which are most important for developing a political model of trade policy determination are emphasized. All of the results are phrased in terms of the *ad valorem* tariff case; the non-tariff barrier case is fully described in the original paper. In the second part of this section, expressions for consumer utility, producer profits and tariff revenue will be derived using the economic model. The relationships between these aggregates and trade policies chosen for two trading partners are explored, and it is proven that if a foreign export sector is sufficiently competitive relative to the domestic producers in its export market, then the aggregate profits of these exporters may be maximized by a non-zero rate of non-tariff barriers. In the final part of this section, the objectives of the government are defined and a procedure for optimizing the government's utility is outlined. This chapter follows the *political support function* approach employed in Hillman (1982), Grossman and Helpman (1994), and much subsequent research.

The Model of the Economy

The model developed in Melitz and Ottaviano (2008) follows much of the literature on intra-industry trade and firm heterogeneity in adopting a model of monopolistic competition among firms. However, rather than using the constant elasticity of substitution demand system first formalized in Dixit and Stiglitz (1977), it employs a linear demand system (Ottaviano, Tabuchi and Thisse, 2002)[1]. In the short-run version of the model employed in this chapter, each firm in the differentiated good sector monopolizes a single variety $i \in \Omega$. The number of varieties available in equilibrium is determined by the pattern of firm exit once all trade policies are determined. Each firm produces $q_i \geq 0$ units of the differentiated good.

[1] The CES monopolostic competition approach has dominated the theoretical literature on firms, product differentiation and trade (Krugman, 1980; Helpman and Krugman, 1985; Melitz, 2003; Bernard, Redding and Schott, 2008). For alternatives without monopolistic competition see Lancaster (1979) and Bernard et al. (2003).

The sole factor of production is a workforce of size L. Each worker consumes $q_i^c = \frac{q_i}{L}$ units of variety i. It is assumed that consumers value consumption of a diversified bundle of the differentiated good, and that no variety is a perfect substitute for any other. The consumer's utility function is defined to generate this 'love-of-variety':

$$U^c = q_0^c + \alpha \int_\Omega q_i^c \, \mathrm{d}i - \frac{1}{2}\gamma \int_\Omega (q_i^c)^2 \, \mathrm{d}i - \frac{1}{2}\eta \Big(\int_\Omega q_i^c \, \mathrm{d}i \Big)^2.$$

The index $i = 0$ represents a homogeneous numeraire good which is produced at a constant cost of 1 by a second sector of the economy. If all of the labor is employed and $q_0^c > 0$ for all consumers, then the inclusion of the numeraire holds wages at unity. The parameter γ controls the extent of love-of-variety. As γ increases, consumers increasingly value consuming a broad range of varieties of the differentiated product; as $\gamma \to 0$, the varieties become perfect substitutes and consumers care only about total consumption $Q^c \equiv \int_\Omega q_i^c \, \mathrm{d}i$. α and η alter relative demand for the differentiated product.

Consumers earn a unit wage, but may have other sources of income, such as redistributed tariff revenue. Consumer income is denoted I^c and the consumer's maximization problem is therefore:

$$\underset{q_0^c, q_i^c}{\text{Max}} \;\; U^c \quad \text{s.t.} \quad q_0 + \int_\Omega q_i^c p_i \mathrm{d}i = I^c.$$

Later when the case of *ad valorem* tariffs is taken up and the government redistributes tariff revenue to consumers, it is assumed that no tariff revenue is internalized by the consumer *for their own purchases*. This maintains the simplicity of the model solutions, which would be only slightly different in absolute terms but analytically far less tractable, and is a plausible approximation if there are a large number of consumers. To save space, I omit the general solution to the consumers problem and refer readers to Melitz and Ottaviano (2008).

After solving the consumer's utility maximization problem to determine demand, welfare can be rewritten using the fact that $\int_\Omega p_i = N\bar{p}$. As shown in Melitz and Ottaviano (2008),

$$U^c = I^c + \frac{1}{2}\left(\eta + \frac{\gamma}{N}\right)^{-1}(\alpha - \bar{p})^2 + \frac{1}{2\gamma}\int_\Omega (p_i - \bar{p})^2.$$

This is included here because we will make use of it to explain certain results.

With the consumers' problem defined, we can now turn to the producers' profit maximization problem. In the differentiated sector, firms differ in their constant marginal cost of production, c. This chapter employs a short-run equilibrium only, focusing on a fixed measure of entrants N_e with marginal costs lying on the interval $c \in [0, m]$. For all of the equilibria considered here, only a subset of the most productive entrants will end up producing.

Developing a two-country model with trade now requires superscripting all parameters and endogenous variables which can differ between two countries, denoted l and h. All solutions will be phrased in terms of country l, and the analagous expression for h will be left out for the sake of brevity. The countries are permitted to vary in size (L^l), number of entrants (N_e^l), the top end of the cost distribution (m^l), and their trade policies. Two policy instruments are explored separately here, an *ad valorem* tariff τ and a non-tariff trade barrier ν. For example, ν^l is a variable cost of trade paid for by a firm exporting from h to l. The cost of one unit of production exported from h to l is $\nu^l c$, so more productive firms have lower trade costs. τ^l is a tariff paid for by consumers importing a good from h to l. An exporter in h earns $p_i^{firm} \equiv p_i^f$ for every unit sold to l's consumers, who pay $p_i \equiv \tau^l p_i^f$. The government earns $(\tau^l - 1)p_i^f$ in tariff revenue for each unit sold.

An important feature of this model is that consumers will not purchase any units of a variety which is too expensive. In the domestic market, this means that some high cost firms will simply be unable to find purchasers for their product, even if it is priced at marginal cost. The marginal cost of the firm that finds no market for their good is called the zero-profit domestic productivity cutoff, and is denoted c_D^l. Similarly, there is a cutoff productivity for exporting firms, above which they can find no market for their good once the extra costs of trade barriers are factored into their prices. This is denoted c_X^l. As long as trade barriers are positive, then $c_X^l < c_D^l$.

The domestic productivity cutoffs are essential for understanding the results of the political model, so two additional comments on their role are in order. First, the cutoffs are synonymous with the extent of competition in the market. To see this, note that prices, sales and profits are all decreasing for a firm of productivity c in the cutoff, whether at home (subscript D) or in the export market (subscript X)[2].

$$\begin{aligned} p_D^l(c) &= \frac{1}{2}(c_D^l + c) \quad & q_D^l(c) &= \frac{L}{2\gamma}(c_D^l - c) \quad & \pi_D^l(c) &= \frac{L}{4\gamma}(c_D^l - c)^2 \\ p_X^l(c) &= \frac{\tau^h}{2}(c_X^l + c) \quad & q_X^l(c) &= \frac{L^h}{2\gamma}\tau^h(c_X^l - c) \quad & \pi_X^l(c) &= \frac{L^h}{4\gamma}\tau^h(c_X^l - c)^2. \end{aligned}$$

Relatedly, a country with a lower cutoff in autarky also has lower average prices for the differentiated product. Because the numeraire's price is fixed at unity, a coun-

[2] Note in the export case the divergence between prices paid by consumers (p_X^l) and those earned by firms ($p_X^{fl} = \frac{p_X^l(c)}{\tau^h}$) which determine the amount of profits. For the case with a variable cost of trade, $p_X^l(c) = p_X^{fl}(c) = \frac{\nu^h}{2}(c_X^l + c)$ and profits are $\frac{L^h}{4\gamma}(\nu^h)^2(c_X^l - c)^2$.

try with a lower cutoff therefore has something closely analagous to a comparative advantage in the production of the differentiated good. In particular, when the implicit definition of the domestic productivity cutoff is presented shortly, it will be clear that l has a comparative advantage in the production of the differentiated good if $\frac{N_e^l}{(m^l)^k} > \frac{N_e^h}{(m^h)^k}$, regardless of country size, so comparative advantage is determined strictly by two Ricardian factors: the number of extant firms and their average productivity. When $\frac{N_e^l}{(m^l)^k}$ increases, l will be said to have improved its competitiveness in the production of the differentiated good.

Recall that we have assumed a fixed measure of entrants in each country with costs of production distributed continuously along a set range. For example, l has N_e^l potential producers which lie on the range $[0, m^l]$ with distribution $G^l(c)$. As noted above, there is no demand in l for products whose marginal cost is greater than c_D^l (for domestic producers) and c_X^h (for foreign producers). Therefore, the total number of firms serving l is

$$N^l \equiv N_e^l G^l(c_D^l) + N_e^h G^h(c_X^h).$$

In order to find solutions for the cutoffs, we must specify a distribution for $G^l(c)$. Melitz and Ottaviano (2008) assume that costs are distributed Pareto, $G^l(c) = (\frac{c}{m^l})^{k^l}$ for $c \in [0, m^l]$. It is further assumed that $k^l = k^h = k$, while m^l and m^h are permitted to differ. Gatto, Mion and Ottaviano (2006) and Luttmer (2007) provide evidence that the Pareto distribution is a good approximation of the empirical distribution of firm productivities within industries. It is, of course, also analytically convenient, and all results from here on out take advantage of this distributional assumption.

Using this functional form, the identities for N^l and N^h can be restated as

$$N^l = N_e^l \left(\frac{c_D^l}{m^l}\right)^k + N_e^h \left(\frac{c_X^h}{m^h}\right)^k$$
$$N^h = N_e^h \left(\frac{c_D^h}{m^h}\right)^k + N_e^l \left(\frac{c_X^l}{m^l}\right)^k .$$

It is also possible to solve for the number of firms serving in each economy in terms of the as yet unknown cutoffs. First, recall that aggregate demand for each variety in l is given by $q_i = \frac{L^l \alpha}{\eta N^l + \gamma} - \frac{L^l}{\gamma} p_i + \frac{\eta N^l}{\eta N^l + \gamma} \frac{L^l}{\gamma} \bar{p}^l$. Second, $q_i^l = 0$ where $p_i^l = c_D^l$ which allows us to simplify this expression and solve for N^l. Third, $\bar{p}^l$, the average variety price faced by consumers in l, is easily solvable in terms of parameters and cutoffs because the distribution of productivities of the firms in market l is the same for both domestic production and imports. This is $\bar{p}^l = \frac{2k+1}{2k+2} c_D^l$. After some simplification, $N^l = \frac{2(k+1)\gamma}{\eta} \frac{\alpha - c_D^l}{c_D^l}$.

Noting that $c_D^l = \frac{c_X^h}{\tau^l}$ and $c_D^h = \frac{c_X^l}{\tau^h}$ we now have two equations in terms of only parameters and the two unknown domestic productivity cutoffs. After some manipulation, the implicit definition of the domestic productivity cutoff for l is:

$$\frac{\alpha - c_D^l}{(c_D^l)^{k+1}} = \frac{\eta}{2(k+1)\gamma} \left(\frac{N_e^l}{(m^l)^k} + (\tau^l)^{-k} \frac{N_e^h}{(m^h)^k} \right) .$$

Note that the definition is identical for the case of a variable cost-of-trade, but τ^l is replaced with ν^l. Finally, it is important to note that the tariff or NTB rate is an explicit function of the cutoff:

$$\tau^l = \left(\frac{(m^h)^k}{N_e^h} \left(\frac{2(k+1)\gamma}{\eta} \frac{\alpha - c_D^l}{(c_D^l)^{k+1}} - \frac{N_e^l}{(m^l)^k} \right) \right)^{-\frac{1}{k}}$$

The value of the domestic cutoff in l therefore determines a unique tariff rate τ^l or NTB rate ν^l. Choosing a level of competition c_D^l is therefore equivalent to choosing a trade policy.

Consumer Utility and Firm Profits in Aggregate

With a productivity distribution fully specified and the cutoffs implicitly solved, it is now possible to develop relatively simple expressions for the aggregates that will be featured in the government's objective function. Much of the analysis of the model will depend on understanding these aggregates so it is worth discussing their features in detail.

Using the solutions for average prices and the number of firms, aggregate consumer utility has a straightforward form:

$$L^l U^c = L^l \left(I^c + \frac{1}{2\eta} \left(\alpha - c_D^l \right) \left(\alpha - \frac{k+1}{k+2} c_D^l \right) \right).$$

Note that the consumers' utility is decreasing in c_D^l, so all else equal consumers prefer a more competitive differentiated product sector[3]. Examining the implicit definition of c_D^l, it is also clear the c_D^l is increasing in both τ^l and ν^l. In terms of utility from their consumption, consumers prefer the freest trade policy possible in order to generate the most competitive home market in the differentiated good. This picture will be complicated somewhat when I^c includes tariff revenue, and is therefore a function of the domestic productivity cutoff.

The total profits for producers located in l are a sum of profits from domestic

[3] $\frac{\partial U^c}{\partial c_D^l} \propto (-\alpha - \alpha \frac{k+1}{k+2} + 2\frac{k+1}{k+2} c_D^l)$. $\frac{\partial U^c}{\partial c_D^l}$ is therefore negative if $c_D^l < \alpha$. Examining the implicit definition of c_D^l, it is clear that this will be the case for any fixed distribution of entrants.

and export sales:

$$
\begin{aligned}
\Pi^l &\equiv \Pi^l_D + \Pi^l_X \\
&= N^l_e \left(\frac{c^l_D}{m^l}\right)^k \int_0^{c^l_D} \frac{L^l}{2\gamma}(c^l_D - c)^2 \mathrm{d}G^l(c) + N^l_e \left(\frac{c^l_X}{m^l}\right)^k \int_0^{c^l_X} \frac{L^h}{2\gamma}(\tau^h)(c^l_X - c)^2 \mathrm{d}G^l(c) \\
&= \frac{L^l}{\gamma\phi^l} N^l_e (c^l_D)^{k+2} + \frac{L^h}{\gamma\phi^l} N^l_e (\tau^h)^{-k-1}(c^h_D)^{k+2}
\end{aligned}
$$

In this expression, $\phi^l \equiv 2(k+1)(k+2)(m^l)^k$ and moving from the first to the second line c^l_X was substituted with $\frac{c^h_D}{\tau^h}$. In the NTB case, the expression for Π^l_D is unchanged while Π^l_X is equal to $\frac{L^h}{\gamma\phi^l} N^l_e (\nu^h)^{-k}(c^h_D)^{k+2}$.

This expression makes clear that the domestic firms' total profits from serving the home market are increasing in the domestic production cutoff, c^l_D. This implies that home-market profits are increasing in the *ad valorem* tariff or the variable trade cost. Because consumers prefer the most open trade policy possible, the outlines of the conflict of interest between producers and consumers is already apparent. When the comparative statics are examined later on, it will be useful to have some sense of how the marginal gain in aggregate domestic profits resulting from an increased domestic productivity cutoff changes with the parameters.

Lemma 1. The Domestic Profits Effect*: the marginal increase in the aggregate profits of firms operating domestically brought about by an increase in the domestic productivity cutoff is:*

1. *Decreasing in γ.*

2. *Increasing in N^l_e and decreasing in m^l.*

3. *Independent of N_e^h and m^h.*

Increases in consumer love-of-variety reduce the profits of any individual domestic firm, holding the number of firms constant, because consumers purchase less of any given variety. They would prefer to spread their consumption out across more varieties, but holding the set of extant firms constant they simply consume more of the numeraire. In the aggregate, this means that increases in the domestic cutoff (which is really an increase in tariffs or trade barriers in our setting) will be less helpful to a given set of domestic firms as consumers increasingly value diversified consumption. In contrast, when $\frac{N_e^l}{m^l}$ increases, meaning that l's firms are more numerous and more productive, the benefits from an increase in trade barriers are greater. The more competitive are l's firms, the more they can take advantage of policy measures which reduce competition from abroad, even though that foreign competition is relatively weaker.

The relationship between Π_X^l and c_D^h is slightly more complex, owing to the complex functional form of the definitions for τ^h and ν^h. One might expect that the profits of l's exporters from exporting are always decreasing in the level of trade barriers in the foreign market. This is not necessarily the case, however, which gives rise to some surprising conclusions about the demand for trade liberalization from exporting firms.

First, consider the effect of a proposed increase in NTBs in l on h's firms. This increase in ν^l is equivalent to an increase in c_D^l. The derivative of h's exporters' profits in l with respect to c_D^l is proportional to

$$-\frac{N_e^l}{(m^l)^k}(k+1)(c_D^l)^{k+1} + (\nu^l)^{-k}\frac{N_e^h}{(m^h)^k}(c_D^l)^{k+1} - \frac{2(k+1)\gamma}{\eta}c_D^l.$$

This expression is monotonically decreasing in ν^l, so we can concentrate on the case where ν^l is in the neighborhood of 1, i.e. l's economy is completely open. A necessary and sufficient condition for Π_X^h to be increasing in ν^l in the vicinity of $\nu^l = 1$ is

$$\frac{\frac{N_e^h}{(m^h)^k}}{\frac{N_e^l}{(m^l)^k}(k+1) + \frac{2(k+1)\gamma}{\eta}(c_D^l)^{-k}} > 1.$$

Appendix A contains a proof that this will hold if $\frac{N_e^h}{m^h}$ is sufficiently large. Furthermore, this condition becomes easier to meet as $\frac{N_e^l}{m^l}$ gets smaller. This, then, is an argument for a non-zero optimal level of trade barriers for l's exporters *in their export market*.

Proposition 1. *If h's firms are sufficiently competitive, its firms exporting to l will find a non-zero rate of NTBs profit-maximizing in the aggregate. As l's firms become less competitive, a lower level of competitiveness among h's firms will be required to make this true.*

Explaining this result requires some care, but it illustrates some interesting features of the model. First, note that our definition of aggregate foreign profits is the product of average foreign exporting profits times the number of foreign exporting firms. The latter, which is $N_e^h\left(\frac{c_X^l}{m^h}\right)$, is diminishing in ν^l, because c_X^l is diminishing in ν^l. This is clearly negative for aggregate foreign exporting profits. Average profits, which are proportional to $(\nu^l)^2(c_X^h)^2 = (\nu^l)^{-k}(c_D^l)^2$, can be increasing or decreasing in ν^l because ν^l has contrary effects on firms in h. On the one hand, it increases the costs of exporting to l, which is clearly negative, but on the other hand, it makes the environment in l less competitive for those firms which continue to export to l. If the impact of the latter is greater than that of the former, than aggregate profits for h's firms might actually increase with higher trade barriers.

Why do the number of firms and their productivity in h and l play a role here? First, note that c_D^l increases more with increases in ν^l as $\frac{N_h^e}{(m^h)^k}$ gets larger, and increases less with ν^l as $\frac{N_h^e}{(m^h)^k}$ increases[4]. So if h's firms are extremely competitive or l's extremely uncompetitive, then a small dose of extra trade protectionism can reduce competitiveness in the economy quite significantly. This reduction in competitiveness (higher c_D^l) is the only benefit to h's firms from protection but it can be significant enough to make them prefer a small level of positive NTBs.

One final piece of understanding comes from examining how changes in NTBs affect firms in h through the productivity distribution. The argument above seems to imply that some individual firms in h must benefit from trade protection because the aggregate profits of h's may increase with small levels of NTBs. This is indeed the case, and can be seen by considering a firm with marginal cost nearly equal to zero. That firm's profits from exporting are $\lim_{c\to 0} \frac{L^l}{4\gamma}(\nu^l)^2(c_X^l - c)^2 = \frac{L^l}{4\gamma}(c_D^l)^2$, which is increasing in ν^l (because the domestic cutoff is increasing in ν^l). Of course, some firms with higher marginal costs will lose from higher trade barriers, for example, if they are now unable to profitably export after trade barriers are raised, or if they make profits very close to zero after NTBs are raised. Finally, consider again the impact of an increase in $\frac{N_h^e}{(m^h)^k}$. This will tend to push the range of operating firms into the lower regions of the cost distribution, exactly the location where there are firms who can benefit from slight increases in trade barriers[5].

[4] See Appendix A1 for a proof.

[5] This result is reminiscent of a result presented in Abel-Koch (2010), which shows that more productive firms may prefer their own government to impose a variable cost-of-production on all firms, domestic and foreign. The result here shows that a similar argument holds for a foreign

The next question is whether under the tariff setting exporting firms will prefer a non-zero tariff in their export market under any circumstances. Appendix A2 contains a proof that for any level of tariffs, the aggregate profits of exporting firms in h *will not* increase with an increase in τ^l. In particular, a non-zero level of tariffs in the export market is never profit-maximizing for exporters in the aggregate, nor is there any circumstance under which an increase in tariffs could increase aggregate profits.

To understand the distinction with the NTB case, it helps to again examine the change in profits brought about by a small increase in tariffs at the firm level. Upon examination of the profit function for exporters, the least negatively affected exporter in h is the most productive firm, which effectively has a marginal cost of 0. Note that unlike in the NTB case, where a firm with zero marginal cost suffers no negative effects from an increase in the variable cost-of-trade, the most productive firm still has a positive profit-maximizing price and so clearly suffers on this front from an increase in tariffs. Is the reduction in competition in l brought about by the increase in tariffs sufficient to compensate the most productive exporter? Appendix A2 contains a short proof that even for the most productive firm, an increase in tariffs reduces overall profits, and so the negative effects of a tariff increase always outweigh any positive effect. This implies that no firms in h can benefit from greater tariffs abroad.

government, and even when the cost of production applies only to imports but it will only apply if the importing firms are dominant in the market. These conditions are therefore similar to a cost of production being imposed on all firms in a single domestic market, so the two results have a similar logic.

How does demand for liberalization among exporters change with the level of product differentiation, or with their competitiveness relative to foreign producers? This question is answered as a comment.

Comment 1. *The marginal increase in the aggregate profits of firms exporting to l brought about by an increase in the export market productivity cutoff in l is:*

1. *Increasing in γ.*
2. *Independent of N_e^h and m^h in the NTB case, and increasing in increasing in N_e^h and decreasing in m^h in the tariff case.*
3. *Decreasing in N_e^l and increasing in m^l in the NTB case. In the tariff case, the change is ambiguous.*

These results are proven in Appendices A2 and A5. The first result is essentially the mirror image of what was described for domestic firms in Lemma 1. Except under the conditions of Proposition 1, foreign firms lose from increased protection in their export market. When consumer love-of-variety is high, any given firm is smaller because consumers are spreading consumption across more varieties. For a given set of exporters, then, losses from trade restrictions are diminishing in love-of-variety.

The second part of the comment shows that changes in the competitiveness of foreign producers have no effect on the intensity of their lobbying for foreign liberalization in the NTB case. This result again illustrates the divisions *among* exporters, reflecting the dual impacts of trade barriers which impede access for all exporters but reduce competition for the most productive exporters. In the NTB case, these forces are exactly balanced: as foreign firms get more competitive they have more to lose from being denied entry but more to gain from denying their fellow firms entry. These competing forces are at work in the tariff case two, but are not exactly equal. Firms losses from greater trade restrictions are decreasing in the competitiveness of producers in the foreign market.

The third part of the comment reflects the fact that exporters generally lose less from new trade restrictions as the producers based in their export market get more competitive. This result is not available analytically for the tariff case, although a similar pattern generally holds.

Finally, in instances where an *ad valorem* tariff is levied by the government on imports, the tariff revenue collected is a proportion of the total export revenues of foreign firms:

$$\begin{aligned}
\mathrm{T}^l &\equiv \frac{\tau^l - 1}{\tau^l}\mathrm{R}_X^l \\
&= \frac{\tau^l - 1}{\tau^l}\int_0^{c_X^h} \frac{L^l}{2\gamma}(\tau^l)^2\left((c_X^h)^2 - c^2\right)\mathrm{d}G^h(c) \\
&= \frac{\tau^l - 1}{(\tau^l)^{k+1}}\frac{L^l}{\gamma\phi^h}N_e^h\left(c_D^l\right)^{k+2}(k+1)
\end{aligned}$$

Evidently, $\mathrm{T}^l = 0$ when $\tau^l = 1$, which is equivalent to a tariff of 0%, and approaches 0 as $\tau^l \to \infty$.

When tariff revenue is introduced to the government's utility function, a number of comparative statics for the marginal increase in tariff revenue for an increase in the domestic productivity cutoff will be useful.

Lemma 2. The Tariff Revenue Effect*: the marginal increase in tariff revenue brought about by an increase in the domestic productivity cutoff is:*

1. *Decreasing in N_e^h and increasing in m^h.*
2. *Generally decreasing in N_e^l and increasing in m^l.*
3. *Generally increasing in γ.*

In particular, the latter two will hold if $\frac{N_e^h}{m^h}$ is reasonably large.

This claim is discussed in Appendix A3. The "reasonably large" language is a little vague but two points of clarification are worth making. First, the tariff revenue term is generally a source of trouble for analytical evaluation of the comparative statics. This is in part because of the analytic indeterminacies of points 2 and 3, but more importantly because the tariff revenue considerations often move in opposite directions to the government's other considerations (i.e. the marginal benefits of increasing the cutoff for domestic profits, described in Lemma 1, and the "maintaining competition effects" described in the next section as part of Lemma 3.) Second, there is still a lot of understanding that can be gained by knowing the usual direction of changes in marginal benefits from raising tariffs as outlined in this lemma. Numerical Simulations will be used to provide a sense of the general direction of comparative statics, when necessary.

Finally, some explanation is in order for each of the results. Tariff revenue plotted against the domestic cutoff generally forms a roughly concave curve. The biggest gains in tariff revenue therefore come at the lowest end of the range of possible cutoffs. Small changes in the parameters tend to move the curve around, including its endpoints, which changes the marginal increase in tariff revenue associated with a given cutoff. Consider some particular cutoff $\bar{c}_D^l$, and imagine that there is some marginal increase in tariff revenue associated with slightly increasing this cutoff. Now suppose that $\frac{N_e^h}{m^h}$ is increased considerably, meaning the differentiated product industry in h is now much stronger. One effect of this will be that any increase in c will increase tariff revenue more, but, the other effect is that the range of possible c_D^l is pushed much lower, because there are so many more firms in the differentiated product market. This latter effect turns out to be dominant in all instances, so the marginal increase in tariff revenue at $\bar{c}_D^l$ when c_D^l is slightly increased will be diminishing in $\frac{N_e^h}{m^h}$.

The other comparative statics work in a similar way. Raising $\frac{N_e^l}{m^l}$ generally shifts the entire curve to the left, which again pushes the cutoffs where the greatest tariff revenue gains arise from raising the cutoff to the left. When consumer love-of-variety increases, the tariff revenue curve is generally shifted to the right because consumers are willing to tolerate more high-priced varieties in order to consume a variegated basket of goods. For a fixed cutoff the marginal tariff revenue gain is therefore pushed higher. It bears repeating that these latter two patterns are not hard and fast, but they appear to be a generally good description, and hold under the conditions discussed in Appendix A3.

The Political Model

This chapter examines tariffs and non-tariff barriers as two separate instances of trade policy, and for simplicity each case is examined in isolation. It is also assumed that the government sets only trade barriers, whether tariffs or the variable cost-of-trade, and does not engage in either export or import subsidization, as in

Grossman and Helpman (1994). The government therefore possesses only one policy instrument, and its problem amounts to deploying that one instrument to pursue its interests[6].

This chapter follows the "political support function" approach identified in Helpman (1997) in order to define the government's objectives. In its simplest form, each governments' objective function is assumed to be a linear combination of consumer utility and industry profits:

$$G^l = \epsilon^l (L^l U^l) + \Pi^l.$$

When tariff revenues are earned and redistributed to consumers, the first terms will also include tariff revenue, T^l. The weight on consumer utility, ϵ^l, determines how the government trades off between an additional unit of consumer welfare and a unit of profits for the industry producing the differentiated product. Note that because of the quasi-linear utility function, this set-up is easily extendable to an economy with multiple differentiated-product industries.

Although this functional form is extremely spare in terms of institutional or political detail, it has several appealing features. It is simple and analytically tractable, but captures the most important tradeoffs inherent in using trade policy to defend producers' interests. The political support approach has been used at least since Hillman (1982), and is employed in the benchmark model of trade policy determi-

[6] Later on in the section on cooperative tariff-setting we will assume that the governments engage in inter-country transfers in order to facilitate trade liberalization, however, the amount of this transfer will be determined residually by the bargaining protocol and the trade policies chosen, so in effect there is still only one policy instrument available.

nation developed in Grossman and Helpman (1994), as well as much of the subsequent literature on trade policy determination. Furthermore, Grossman and Helpman (1994) provide microfoundations for this simple functional form with campaign contributions of firms. Using a menu auction approach, it demonstrates that contributions will be proportional to profits ('truthful') in the most plausible types of equilibria, which induces an otherwise consumer-representing government to respond to the level of producer profits. For the moment, this chapter does not employ this argument and simply assumes the functional form outlined above. For a complete development of the political contributions argument in a model with firm heterogeneity, see Abel-Koch (2010). Finally, note that whatever implicit story one might use to justify this political support approach, it is assumed that all firms – large or small, exporter or not – are represented equally in the objective function of the government, in the sense that a dollar of profits for any firm is treated equally.

A number of different settings – cooperative and non-cooperative, tariff and non-tariff barriers – will be explored in the following sections, but two features of the government's optimization problem are common throughout. First, it is generally easier to optimize the domestic production cutoff, c_D^l, and then determine the rate of tariffs or NTBs implied by this cutoff. Recall that the tariff or NTB rates are a one-to-one function of the domestic production cutoff. If the trade policy is the only choice available to the government, then choosing a cutoff is equivalent to choosing a trade policy. Analysis of how the optimal tariffs or NTBs vary with key parameters will thus generally entail a two-step procedure, wherein changes in optimal c_D^l are first identified, followed by implied changes in optimal trade policy.

Interpreting many of the results which follow will require bearing in mind this two-stage procedure, so it is worth restating the approach in more vivid language. In the first stage, consumers and producers fight over the level of competition in the differentiated sector of the economy. Consumers generally prefer a more competitive environment (which means lower prices and more access to imports) and producers prefer a less competitive economy. In the second stage, the government, having balanced these competing interests and decided on a level of competitiveness, chooses the level of trade barriers that will implement the desired level of competition. This two-step approach will be especially useful for interpreting the comparative statics, where two questions are paramount. How does a change in some parameter affect the incentives or relative power of the two sides when settling the level of competitiveness in the economy? And, once a level of competitiveness is decided upon, how does a change in the parameter affect which trade policy must be chosen to implement that level of competition?

In a number of special cases that follow, it will be shown that changes in key parameters lead to no change in the government's optimal domestic productivity cutoff, so it is helpful to answer this second question directly. Using the definitions of τ^l and ν^l above, the following lemma is straightforward.

Lemma 3. The Maintaining Competition Effect*: When changes in the following parameters induce no change in c_D^l, tariff or non-tariff rates are:*

1. *Decreasing in γ.*

2. *Increasing in N_e^l and N_e^h and decreasing in m^l and m^h.*

3. *Independent of ϵ^l.*

The logic behind these results is straightforward. If a given level of 'competitiveness' (i.e. c_D^l) is demanded for the economy, then trade policy must compensate for changes in the parameters to achieve that. As γ increases, consumers love variety more which will tend to permit more, and higher cost, firms to enter. To keep the economy competitive, borders must be opened to permit more foreign firms entry. In contrast, when there are more firms either at home or abroad, the economy will tend to be more competitive, so maintaining the same domestic cutoff requires reducing competition from foreign firms and so an increase in tariffs or trade barriers. This illustrates the general logic of the government's problem: consumers and producers are at loggerheads over how competitive the economy should be. Once this issue is settled, trade policy must adjust to implement the agreed-upon level of competition.

An alternative heuristic way of motivating these effects is to think of them as the voice of consumers, contra producers who speak through the effects outlined in Lemma 1. When love-of-variety is high, consumers demand greater access to foreign varieties. When either the domestic or the foreign industry is larger and more competitive, consumers will tolerate greater trade barriers, as a concession to producers.

A second key feature of this model is that when the government's objective function is composed of any linear combination of consumer utility, firm profits, and tariff revenues, whether foreign or domestic, then the optimal trade policy τ^l or ν^l is not a function of the trade policy chosen by the foreign country (τ^h or ν^h). The sole exception to this is when some external constraint, such as that imposed by the bargaining problem without inter-country transfers explored later on, restricts the set of available trade policies. This fact is sufficiently important to record as a Lemma.

Lemma 4. *For any unconstrained trade policy determination problem, the optimal trade policy τ^l does not depend on the value of τ^h.*

To see this, first note that the optimal trade policy in l is determined solely based on c_D^l and could not otherwise be a function of τ^h. Then note that G^l is comprised of additive components, each of which depends only on c_D^l (as with U^l and Π_D^l) or c_D^h (in Π_X^l or T^l) but never both. Therefore, while the value of G^l certainly depends on both τ^l and τ^h, the trade policy in l which maximizes G^l does not depend on the trade policy in h, and vice versa.

There are theoretical and practical implications of this. On the practical side, this lemma simplifies the problem of tariff determination for the analyst considerably. Each government's problem can be solved as a separate question, rather than requiring the joint solution of systems of equations. On the theoretical side, each government pays scant heed to the trade policy adopted by its trade partner when determining its own trade policy in a non-cooperative setting. Their own optimal trade policy is entirely independent of the policy chosen abroad. As will be discussed later on, this precludes any credible commitment to retaliate against high trade barriers abroad with the same policy at home. Doing so would only harm the government's own interests even further.

This section has introduced the model of the economy, derived expressions for producer and consumer welfare, and defined the government's approach to making policy. Government's consider the impact of trade policy on both consumers and producers. The policy setting game is conceptualized as a disagreement over how competitive the economy should be, and the relationships between the marginal benefits of 'extra competitiveness' and changes in the parameters were derived for each actor in the economy. Once a level of competition is decided upon, the trade policy is altered to effect that level of competition. The next section provides the baseline case for making trade policy against which all others are judged.

Non-Cooperative Trade Policy Setting

With the economic and political model described above, it is now possible to explore the determinants of trade policy in both non-cooperative and cooperative settings. This first section explores non-cooperative trade policy determination under three settings. In the baseline case, the government independently sets its own rate of tariffs or NTBs, and it is assumed that all revenues from the trade policy are deadweight loss. This is the usual assumption for non-tariff barriers, although arguably for many sorts of variable trade costs there are interests in either the exporting or importing country which earn rents from non-tariff barriers. It is of course an unusual assumption for tariff revenues, and one that will be remedied later on. Under this restrictive assumption, it is shown that no interior solutions for optimal trade policies exist, however a set of comparative statics are easily derivable which identify under what conditions the economy will be open and under what conditions it will be autarkic.

In the second and third subsections, two settings in which interior solutions are possible are explored. In the first extension of the baseline model, optimal NTB rates are explored when either a subset of firms operating abroad are assumed to have owners at home or foreign firms are capable of lobbying. When the interests of these foreign-based firms are incorporated into the objective function of the government, NTBs are (weakly) lower. In the second extension, a model with tariff-setting is explored in which tariff revenues are redistributed to consumers. It is shown that consumers benefit from a small, positive tariff due to a terms-of-trade externality which tends to push up tariffs in economies that would otherwise be open when tariff revenue is lost. On the other hand, the inclusion of the tariff revenue motive can also push tariffs down from autarkic levels in political settings where producers are well-represented, because they provide an extra incentive for a positive level of trade. Both of the settings with interior solutions illuminate the role various interests play in the political economy and how their relative strength influences trade policy. In addition, these examples generate a set of comparative statics which link love-of-variety, Ricardian comparative advantage factors, and political influence with trade policy outcomes.

The Baseline Case: No Earned Revenue from Tariffs or NTBs

The first case explored here is a unilateral (or non-cooperative) trade policy setting game, where all revenues from tariffs or NTBs are lost. As noted previously, this is a less problematic assumption for the NTB case but is quite unrealistic in the tariff case. However, it is useful to examine this simple case to develop a baseline for comparison with more complex settings, and to draw out some of the themes which come out of this model in the clearest setting possible. It is first shown that only corner solutions exist for this simple setting, then comparative statics are derived emphasizing the government's tradeoffs in attempting to satisfy consumers and producers.

When all tariff or NTB revenue is lost, consumers earn income only from wages, which the numeraire pins down at $I^c = 1$. Firm profits are $\Pi^l = \frac{L^l}{\gamma\phi^l} N_e^l (c_D^l)^{k+2} + \frac{L^h}{\gamma\phi^l} N_e^l (\tau^h)^{-k-1} (c_D^h)^{k+2}$ but note that the exporting profits, represented by the second term, are independent of any of the policy instruments controlled by the government in l. This is a specific case of the principal discussed in Lemma 4. The government's maximization problem therefore amounts to the following:

$$\underset{c_D^l}{\text{Max}} \;\; \epsilon^l L^l \left(1 + \frac{1}{2\eta}\left(\alpha - c_D^l\right)\left(\alpha - \frac{k+1}{k+2} c_D^l\right)\right) + \frac{L^l}{\gamma\phi^l} N_e^l (c_D^l)^{k+2} \;\text{ s.t. }\; \underline{c}_D^l \leq c_D^l \leq \bar{c}_D^l.$$

In this statement, $\underline{c}_D^l$ is the cutoff when τ^l or ν^l is set at its minimum, which is unity, and $\bar{c}_D^l$ is the cutoff which prevails in autarky, i.e. as τ^l or $\nu^l \to \infty$. As noted in the section introducing the model of the economy, consumer utility is decreasing in c_D^l and producer profits are increasing in c_D^l so the government's problem amounts to a straightforward trading off of consumer versus producer interests.

Proposition 2. *When the government unilaterally sets tariffs or non-tariff barriers, and all tariff or NTB revenue is lost, no interior solutions are possible. The country is either completely open to trade or completely autarkic.*

The proof of this is contained in Appendix A4.

A practical implication of Proposition 1 is that this baseline case features only the producer profits effects of Lemma 1. Deriving the comparative statics is therefore straightforward. The key questions for the government are the following: How important are consumer interests relative to producer interests? And, under what circumstances are the producers in the differentiated sector capable of making significant profits?

To illustrate, it helps to consider three parameters which highlight these trade-offs. When ϵ^l is very large, the weight placed on consumer interests is greater, so the government is under greater pressure to increase competition (i.e. lower trade barriers) to satisfy consumer interests. If ϵ^l is very small, the surer route to maximizing its objective function is to ensure that producers are as profitable as possible by closing the economy. The fixed number of entrants, N_e^l acts in the opposite direction, but the logic is similar. When there are many incumbent firms, there are greater opportunities for firm profits and so the interests of producers will be weighted more highly in the government's objective function. If there are very few firms domestically, consumers' interest in consuming a variegated bundle of goods (via the import channel) will predominate. Finally, note that the number of worker-consumers, L^l, affects both the weight of consumer interests and the potential of the differentiated product industry to earn profits, and because it does so equally in each case, the government's preferred level of trade barriers is *not* affected by the number of workers in this setting. The complete set of comparative statics for the optimal trade policy are outlined below.

Comparative Static 1. *When the government unilaterally sets tariffs or non-tariff barriers, and all tariff or NTB revenue is lost, the level of tariffs or trade barriers are, weakly and* *discontinuously:*

1. *Decreasing in* ϵ_l
2. *Decreasing in* γ
3. *Increasing in* N_e^l *and decreasing in* m^l
4. *Independent of* N_e^h*,* m^h *and* L^l*.*

The role of consumer love-of-variety, γ, is essential in this model and so worth exploring in detail. As γ increases, consumers' utility for a given c_D^l is unchanged, reflecting the fact that c_D^l is the crucial summary statistic of the consumption environment. In contrast, when γ is greater, producers earn fewer profits in aggregate for a given domestic production cutoff. This occurs because as love-of-variety increases, consumer demand for any given variety decreases. Holding the number of firms constant, each producer has less to gain from trade protection and so is less able to influence the government. Because this baseline case features only corner solutions, the key impact of an increase in consumer love-of-variety is not that consumers are more vociferous in their demands for foreign varieties, but that producers gain less from trade protection. Put another way, the corner solutions tend to suppress the "maintaining competition" effects of Lemma 3, which are interpreted here as the voice of consumers.

Tariff and NTB rates are also decreasing in m^l. This occurs because as m^l increases for a fixed number of firms, firms are less productive on average and therefore less profitable overall. This diminishes the weight of producer interests in the government's objective function relative to consumer interests. Finally, the number and productivity of the foreign producers in h has no impact on whether the economy is open or closed. This result relies strongly on the fact that there are no interior solutions, however. If we were to preserve the same structure of the problem, but artificially generate interior solutions through some penalty on extreme values, then trade barriers would be decreasing in m^h, reflecting the reduced gains for consumers from trade openness, and increasing in N_e^l reflecting the greater gains. These are again an instance of the "maintaining competition" effects which we will see later.

The result with both love-of-variety and the Ricardian comparative advantage illustrate an important theme in the literature on trade protection, which was first highlighted in Grossman and Helpman (1994). In that model, equilibrium rates of tariffs are increasing in the total output of the domestic industry relative to imports. This occurs, in part, because larger domestic industries have more to gain from trade protection. Although the setup is different here, a similar result holds in that a larger and more efficient industry secures greater protection than a small or unproductive one. Trade protection in this political setting is less about protecting the weakest industries, therefore, than it is about further enriching the strongest.

MNC's, Foreign Firms and Trade Liberalization

This section alters the baseline case by introducing the profits of firms based in the foreign market to the governments' objective function. Before motivating this inclusion substantively, two analytical implications of this addition should be mentioned. First, when the government takes account of the profits of foreign-based firms, interior solutions are possible. Second, because interior solutions are now possible, this case of the model features both the "producer profits" effects of Lemma 1 and the "maintaining competition" effects of Lemma 3. The baseline case included only the former because the economy was always completely closed or open, so no adjustment in the trade policy was necessary to ensure that the level of competition fought over by producers and consumers was implemented, once a complete swing to autarky or openness was decided upon. In the next section, when tariff revenue is introduced, these two effects will be supplemented by the tariff revenue effects of Lemma 2, so the three non-cooperative cases form a natural progression of layered and increasingly complex political pressures.

Two settings can motivate the addition of the profits of foreign-based firms to the government's objective function. First, firms with plants in the foreign market might be owned domestically. These multinational firms have similar interests to foreign-owned firms based abroad with respect to trade policy. Except under the conditions described in Proposition 1, they prefer a more open economy for their export market which also happens to be the location of their corporate headquarters.[7] Second, foreign firms may be capable of influencing the government's

[7] The approach here does not provide a complete treatment of the choice of location by multinationals, as in Helpman (1984), Yeaple, Helpman and Melitz (2004) and Antras (2003), for example. Nor does it take up the empirical facts of multinational enterprises, for example, that they are larger and more productive, and tend to operate in industries with significant intra-industry trade. Instead, it is simply assumed that a proportion of *all* firms operating abroad are owned by individuals at home, and the profits of these individuals enter the government's objective function. Although this approach is stylized, it is a reasonable treatment of a short-run model which

decision-making, perhaps through lobbying. Not surprisingly, the results from this model generally echo the main conclusions from previous work: foreign lobbying on trade policy generally serves to reduce trade barriers.[8]

Either of these two approaches require a weighting of foreign firms' interests in the objective function of the government. For the sake of simplicity, it is assumed that either an evenly distributed proportion of firms $\beta < 1$ are multinationals, or that the weight placed on the interests of foreign-based firms is equal to β. Under this second interpretation, it is again assumed that $\beta < 1$ although this somewhat restricts the generality of the results. However, this assumption facilitates identification of the comparative statics in the tariff case, and is not unreasonable on its face. Using either of these two interpretations of β, the government's objective function is

$$G^l = \epsilon^l L^l U^l + \Pi^l + \beta \Pi^h.$$

Due to the separability of the trade policies, this is equivalent to choosing c^l_D to maximize $\epsilon^l L^l U^l + \Pi^l_D + \beta \Pi^h_X$.

Proposition 3. *When the government unilaterally sets trade barriers, and is in part maximizing the profits of firms operating abroad, interior solutions are possible. Under settings which would otherwise feature autarky, the inclusion of foreign firms' profits makes NTBs*

features no firm entry and yields sensible results which would likely result from a more complete model of the firms' location decision.

[8] The lobbying of foreign firms in the American context has been explored in Gawande, Krishna and Robbins (2006) and in Canada in Stoyanov (2009). This topic has been explored theoretically in Hillman and Ursprung (1988), Das (1990), and Husted (1991).

or tariffs weakly lower. Under settings that would otherwise feature complete openness, the inclusion of foreign firms' profits can make NTB rates higher, as in Proposition 1.

Appendix A5 provides the first- and second-order conditions for an interior solution, and also demonstrates that as ν^l approaches autarkic levels, the marginal benefit of additional trade barriers for foreign producers is negative. This seems obvious, but recall that Proposition 1 demonstrated that under certain conditions, firms operating in h and exporting to l can find a non-zero level of NTBs profit-maximizing in the aggregate. In particular, if the two countries are extremely unequal in their level of competitiveness, such that h's firms are significantly more numerous and more productive than l's, then h's firms might prefer a positive rate of NTBs in l. The intuition behind this result was that a positive rate of NTBs in l redistributes market share in l from h's less productive exporters to its more productive exporters. For these highly productive exporters, increases in variable costs of trade (which are proportional to marginal cost) are relatively unimportant, while their sales benefit substantially from the less competitive environment in l.

Proposition 1 is an 'optimal tariff' argument with two twists: foreign producers, who we usually expect to favor unilateral liberalization in their export markets, can in fact benefit from increased non-tariff barriers to trade. The key implication of this proposition here is that, under certain circumstances, foreign producers will actually be lobbying to push tariff rates up. The inclusion of their profits in the government's objective function can therefore make NTB rates higher than they would have been in situations where the economy would otherwise be open. The inclusion of the profits of foreign exporters does not solely work to reduce trade barriers, therefore, and under the right circumstances can actually push the rate of NTBs up from zero. Note, however, that in the case of tariffs the aggregate profits of foreign firms are always decreasing in the domestic productivity cutoff, so for this case the inclusion of foreign firms' profits always lowers equilibrium tariffs.

It is also worth noting that an interior solution for tariff or NTB rates cannot be taken for granted. For those situations in which the economy would otherwise be autarkic, an interior solution requires that foreign firms' profits be sufficiently important to the government. In terms of parameters, this is a requirement that β be sufficiently large, and Appendix A5 derives and states the exact sufficient condition for the NTB case. The intuition for this is straightforward. In the baseline case, if the government values producer profits highly then without the influence of foreign-based firms the economy will be autarkic. In order to overcome this, the interests of foreign firms must be great enough in the government's eyes to overcome the pressure for protection exerted by firms located in l.

Finally, the comparative statics from Proposition 2 are largely replicated for this case, with the exception that the competitiveness of foreign producers now impacts equilibrium trade policy. This occurs because the "maintaining competition" effects, which are suppressed when only corner solutions exist, are present in this case.

Comparative Static 2. *When the government unilaterally sets tariffs or non-tariff barriers, and is in part maximizing the profits of foreign-based firms, the level of tariffs or trade barriers are:*

1. *Decreasing in* γ

2. *Increasing in N_e^l and N_e^h and decreasing in m^l and m^h*

3. *Decreasing in β, under most circumstances.*

4. *Either increasing or decreasing in ϵ^l.*

Appendix A5 discusses how to identify the signs of the comparative statics, with some details on the role played by the foreign producer profits term[9].

The effect of γ operates as in Proposition 2, pushing down c_D^l. This occurs because consumers' interests become relatively more important in the government's objective function compared to the interests of domestic firms. As before, this is so because each domestic firm is less profitable for a given c_D^l as love-of-variety increases. The direct effect of increasing love-of-variety on NTB and tariffs rates also pushes trade barriers down, as described in Lemma 3. Maintaining the same cutoff that consumers and firms have agreed between them requires more competition from abroad as love-of-variety increases.

The parameters which determine the competitiveness of l's industry operate predictably. When l's firms are more numerous or more productive, the potential gains from protection are larger, and their influence on the government is enhanced. This effect, along with the 'maintaining competitiveness' effect outlined in Lemma 3, tends to increase trade barriers.

[9] In the NTB case, it is shown that Π_X^h can be decomposed into a term which is independent of love-of-variety and the Ricardian comparative advantage parameters, and $-\beta\Pi_D^l$. We can therefore use the comparative statics from Lemma 1 to model c_D^l. For the tariff case this simple decomposition is not possible, so a more in depth investigation of Π_X^h is required.

The role of the Ricardian comparative advantage factors in the exporting country also operate predictably. Recall from Comment 1 that for the firms operating in h which can influence the government in l, greater competitiveness unleashes two forces. On one hand, it increases the pressure they place on l's government to lower barriers, all else equal, because they can gain more from trade. However, greater competitiveness also means they can benefit more from a less competitive economy in l (i.e. higher c_D^l). In the NTB case, it turns out that these two contradictory forces exactly cancel one another out and so changes in the competitiveness of h's firms have no effect on the equilibrium domestic productivity cutoff chosen by the government in l. In the tariff case, this exact equality is broken but changes in foreign demands are muted for the same reasons. In other words, for both tariff and non-tariff barriers, the competitiveness of h's firms affects equilibrium trade policy in primarily via the effects described in Lemma 3. l is always more open as h's firms become more numerous and productive.

The utility-maximizing rate of NTBs, from the government's perspective, is almost always decreasing in β. This result makes sense using either interpretation of β: if a larger proportion of firms based in h are owned in l, or if foreign firms are more influential, we would expect the government to respond by lowering tariffs. The exception to this are those situations where foreign-based firms actually benefit from small levels of trade barriers as described above.

Finally, NTB rates have an ambiguous relationship with ϵ^l. This reflects the fact that, depending on various parameter values, the marginal benefits of reduced tariff barriers might be greater for consumers or foreign producers. Increasing ϵ^l

therefore changes the weight the government places on two forces which both favor lower trade barriers – along with the weight placed on domestic producers – and so can raise or lower trade barriers in equilibrium depending on which group is stronger in articulating their demands for free trade in opposition to the domestic producers.

Setting Tariffs with Tariff Revenue Distributed

We now move to a more realistic setting for the case of tariffs in which tax revenues collected by the government are redistributed rather than lost. For the moment, it is assumed that tariff revenue is costlessly distributed among all consumers equally. Each consumer's income is therefore $I^c = 1 + \frac{T^l}{L^l}$. As noted above, maintaining the simplicity of the price and demand equations requires that consumers do not directly internalize the tariff revenue from their own purchases. This assumption is probably a realistic approximation of consumer behavior for any economy with a reasonably large number of consumers, which means that an individual's share of tariff revenue from their own purchase of a single good is nearly zero.

When tariff revenue is redistributed to consumers, and foreign firms have no influence on trade policy, the government's objective function is

$$G^l = \epsilon^l (L^l U^l + T^l) + \Pi^l.$$

Two important changes are generated by the inclusion of the term for tariff revenue. First, interior solutions are now possible, because the tariff revenue term can have a negative second derivative, and are indeed probable, as is shown next. Second, the redistribution of tariff revenues generates pressures for positive tariffs under circumstances where tariffs would otherwise be zero in the case where tariff revenue is lost. This is an instance of the 'optimal tariff' argument for consumers (Johnson, 1953). However, tariff revenue can also generate added pressures for a more *open* economy. This occurs because in economies that would otherwise be autarkic due to the power of producers' interests in the government's decision-making, redistributed tariff revenue provides an extra incentive for consumers to demand a more open economy. Propositions 4 and 5 formally state these two arguments.

Proposition 4. *When the government redistributes tariff revenue to consumers, a non-zero* ad valorem *tariff maximizes consumer welfare. In a political equilibrium, the economy will not be completely open.*

Proposition 5. *When the government sets tariffs to maximize G^l, the economy will not be completely closed if N_e^l is sufficiently small, or m^l, γ or ϵ^l sufficiently large.*

Appendix A6 contains a proof of these two claims.

A number of recent papers have explored the question of welfare-maximizing non-zero tariffs in the context of trade models with firm heterogeneity[10]. Collectively, these papers demonstrate that the sources of pressure for non-zero tariffs in trade models with firm heterogeneity are both multi-faceted and can depend strongly on model assumptions. This model is no exception, but examination of consumer utility sheds some light on the forces at work. When tariff revenue is

[10] For examples, see Demidova and Rodríguez-Clare (2009), Cole and Davies (2011), Felbermayr, Jung and Larch (2011) and Felbermayr and Jung (2012). Felbermayr and Jung (2012) argues that these 'optimal tariff' results can be sensitive to the assumption of an outside sector pinning wages at unity, which the model analyzed here includes.

distributed, consumer utility can be rewritten as:

$$U^c = 1 + \frac{T^l}{L^l} + \frac{1}{2}\left(\eta + \frac{\gamma}{N^l}\right)^{-1}(\alpha - \bar{p}^l)^2 + \frac{1}{2\gamma}\int_{\Omega}(p_i^l - \bar{p}^l)^2.$$

Two effects of trade restrictions are unambiguously negative. First, as would be expected in any model, the prices of the differentiated varieties, here represented by the average price $\bar{p}^l$, go up. I return to the question of the passthrough of tariffs into prices in a moment. Second, and a feature which is unique to models with love-of-variety, the measure of total varieties available to consumers is reduced. Jointly these ensure that the second-to-last term is decreasing in τ^l. The final term is less clear, however. Melitz and Ottaviano (2008) shows that this term is equivalent to $\frac{N^l}{2\gamma}\sigma_p^2$ where $\sigma_p^2 = \frac{k}{4(k+1)^2(k+2)}(c_D^l)^2$. This term can be thought of as consumers desire for price variability, which allows them to consume more lower-priced goods, if average prices and the number of varieties are held constant. The effect of a tariff increase on this term is ambiguous, because while the variance of prices increases (which consumers prefer all else equal), the measure of varieties diminishes[11]. This price variability effect is therefore one channel which reduces the negative impact of tariff increases on consumers.

Two points bear stressing, however. First, no matter how positive the final term may be, the net effect of an increase in tariffs on consumers' utility *from consumption* is negative. Second, Proposition 3 makes clear that no matter how negative the effect of tariffs is on utility from consumption, the redistributed tariff revenue is enough to compensate consumers when τ^l is in the vicinity of 1. In particular, the 'optimal tariff' argument is robust to the fact that tariffs negatively affect both prices

[11] Upon simplifying, a sufficient condition for the final term to be increasing in tariffs is $c_D^l < \frac{\alpha}{2}$.

and available variety.

The second, and most important, channel through which tariffs benefit consumers is therefore the terms-of-trade externality. Changes in the terms-of-trade have been the focus of the optimal tariff literature from its beginning, including in variants with a foreign monopolist, which closely resemble the case here (Johnson, 1953; Brander and Spencer, 1984, 1992). Because all prices are measured relative to the numeraire, a terms of trade gain occurs if the prices charged by foreign producers, not including tariffs, drop in the wake of trade liberalization. Recall that the export price earned by a firm in h is $p_X^{hf} = \frac{1}{2}(c_X^h + c)$. Appendix A1 contains a proof that c_X^h is decreasing in τ^l, which implies that for any given variety, p_X^{hf} is decreasing in τ^l, too. This shows that when l levies a tariff, at least some of the cost associated with that tariff is externalized to foreign producers, while of course all of the gains in tariff revenue are internalized. In both the standard trade model with a large country and a model with single foreign monopoly, this terms-of-trade externality is sufficient to make a small tariff optimal in a linear demand system (Feenstra, 2004, Chapter 7). Here, there are additional negative effects of tariffs than those on prices – the reduction in varieties – but Proposition 3 makes clear that in spite of this, a small non-zero tariff is still optimal for consumer welfare[12].

[12] The long-term version of the Melitz and Ottaviano (2008) model features a similar result although the mechanism is entirely different. In it, a non-zero level of non-tariff barriers can be welfare improving, but the result relies on free entry of firms. In that case, unilateral liberalization by one country will create very strong incentives for entry in the other country. This permits firms to jump the trade barriers of the now more protected country, relative to the *status quo ante*, and export back to the liberalizing country. Perhaps surprisingly, the force of this relocation affect is so

Together, Propositions 3 and 4 show that redistributed tariff revenue tends to "pull in" trade policy from the extremes of complete openness or total autarky which prevailed when tariff revenue was lost. Proposition 3 is absolute about this – there will always be a non-zero tariff in equilibrium when tariff revenue is not lost – while Proposition 4 is conditional on certain parameter values. Each of these requirements in Proposition 4 boil down to the same thing, however: l's firms in the differentiated product industry cannot be too potentially profitable, or their interests will swamp those of consumers. As an example, if N_e^l is very large, which means l's differentiated product industry can gain substantially from tariffs, than consumers' demands for more varieties and tariff revenue will simply be overridden in the government's objective function. Similarly, if γ is very small, then each firm which survives to produce is potentially very profitable so there are extremely strong pressures from the industry for protection.

Before moving on to the next case, it is worth revisiting the comparative statics when tariff revenues are redistributed. Some of these are intractable analytically, because of the complex form of the expression for tariff revenue. Others are simply indeterminate in sign, because the tariff revenue effect introduced in Lemma 2 works in the opposite direction to the domestic profits and maintaining competition effects defined in Lemma 1 and 3. Despite these indeterminacies, a number

strong that unilateral liberalization actually *increases* the domestic production cutoff in the liberalizing country, and so reduces welfare. This chapter however relies only on short-term equilibria, which precludes effects based on relocation or changes in the pattern of firm entry. Proposition 3 therefore relies on a very different mechanism over a different time horizon to generate a similar result.

of revealing patterns emerge when the numerical simulations are examined. As described in Appendix B1, the results differ sharply if the ϵ^l parameter is large, so Table 4.1 reports only simulations where ϵ^l is small.[13]

Four patterns emerge from the comparative statics. First, tariffs are generally decreasing in the consumer love-of-variety parameter, γ. Recall that both the 'producer profit' and 'maintaining competition' effects suggest that increases in love-of-variety will reduce trade barriers. However, the marginal gain in tariff revenue from an increase in trade barriers is generally increasing in love-of-variety, because consumers will be less responsive to price increases brought about by raising tariffs. The simulations suggested that the first two effects generally outweighed the third. The only exceptions occurred where ϵ^l is very large. In this case, the 'producer profit' effect is negligible and the impact of an increase in love-of-variety was

[13] Three cases were examined in order to isolate the role played by ϵ^l. In the first group, tariff revenue is taken out of consumers' welfare, and is assumed to be another maximand in the governments' objective function which has a weight of unity. Assuming a weight of one is a simplification to avoid proliferating parameters, but it is consistent, for example, with a setting where the government distributes tariff revenues to firms. This serves to isolate the effect of collecting tariff revenue from variation in consumers' importance to the governments. In the second group, tariff revenue is distributed to consumers but only cases where ϵ^l is relatively small are considered (in the numerical simulations reported here, $\epsilon^l < 2$). In the third group, cases where ϵ^l is large are considered, which means that the government acts like a consumer welfare maximizer. The size of ϵ^l is generally quite important, because the tariff revenue term is the source of indeterminacies in the comparative statics. When ϵ^l is extremely large, all of these ambiguities are highlighted, while the relatively clear comparative statics generated by interaction of the producer profits term with the consumer utility term are obscured.

Table 4.1: This table provides a heuristic account of the forces at work in the non-cooperative tariff-setting problem, and reports the proportion of each simulated comparative static that was *negative*. Two stylized equations help with the interpretation: 1. The Producer Profits Effect + Tariff Revenue Effect = Δc^l_D 2. Δc^l_D+ The Maintaining Competition Effect = $\Delta\tau^l$. For example, then, an increase N^l can push c^l_D up or down because the DP and TR effects are contradictory, although the simulations suggest that the TR effect was usually dominant and c^l_D is decreasing in N^l. The MC effect, which pushes τ^l up, generally did not do so enough to compensate for the TR effect.

	MC Effect	PP Effect	TR Effect	$\Delta\tau^l$	$\Pr(\Delta\tau^l < 0)$	Δc^l_D	$\Pr(\Delta c^l_D < 0)$
γ	$-$	$-$	$+$	$-$	.95	$+$	0
N^l	$+$	$+$	$-$	$+/-$	.56	$-$	.99
N^h	$+$	0	$-$	$+$	.16	$-$	1
m^l	$-$	$-$	$+$	$+/-$	.44	$+$	.01
m^h	$-$	0	$+$	$-$	.8	$+$	0
ϵ^l	0	$-$	$+$	$-$	1	$-$	1

unclear.

The first row of Table 4.1 presents this result heuristically. The maintaining competition and producer profits effects tend to push equilibrium tariffs down, denoted by a negative sign, when love-of-variety increases. The tariff revenue effect pushes tariffs up, indicated by the positive sign. The table also records whether the comparative static was largely positive or negative. For example, when γ increases, equilibrium tariffs decreased in 95% of cases despite the fact that the domestic productivity cutoff increased in 100% of cases. For this reason, I consider the claim that tariffs are decreasing in love-of-variety to be relatively robust to the inclusion of the tariff revenue term which exerts a countervailing force.

Second, as long as ϵ^l isn't too large, tariffs are generally decreasing in ϵ^l. When tariff revenue is not distributed to consumers, it makes sense that increasing the weight on consumer utility will tend to push down tariffs, and this result was quite sharp in the simulations. When tariff revenue is distributed to consumers, but ϵ^l is reasonably low, an increase in ϵ^l still tends to decrease tariffs because it down-weights producers' interests relative to consumers' interests, while maintaining the tradeoff between tariff revenue and utility for consumers. When ϵ^l is extremely high, producers' interests are essentially irrelevant and so there is very little change in tariffs with changes in ϵ^l. Tariff setting is driven almost entirely by the optimal tariff considerations outlined in Proposition 4.

Third, N_e^h and m^h each have ambiguous relationships with the equilibrium tariff, although the general tendency is consistent with the patterns in Comparative Statics 1 and 2. This reflects the tensions between the tariff revenue effect of these parameters (when $\frac{N_e^h}{m^h}$ increases the marginal tariff revenue from increasing c_D^l decreases, which pushes the cutoff down) and the direct effect on tariffs (where $\frac{N_e^h}{m^h}$ tends to push tariffs up, because the same cutoff can be achieved with higher tariffs). These two forces push in opposite directions, although the simulations suggest there is a bias towards the 'maintaining competition' effects described in Lemma 3. N_e^l and m^l operate very similarly to the equivalent parameters for h, plus the addition of a 'producer profits' effect. When $\frac{N_e^l}{m^l}$ increases, the firms in l earn greater profits from an increase in tariffs. This adds an extra force which is pushing up the cutoff, and so pushing up tariffs. Still, the overall impact of changes in these parameters is ambiguous because the tariff revenue force works in a different direction than the other two forces.

Finally, it is worth noting how these comparative statics measure up against the other settings without the distribution of tariff revenue. The tariff revenue term plays a generally disruptive role in analysis of the model, however, the results that trade barriers are diminishing in γ and ϵ^l are relatively robust. The comparative statics involving the comparative advantage terms are generally small in size or indeterminate in direction because of the addition of the tariff revenue term, however.

This section has presented three cases where a government sets trade policy unilaterally, considering both the interests of firms and consumers when making its decision. While no interior solutions occur in the simplest setting with no tariff revenue distribution or foreign firm lobbying, interior solutions are possible and even likely in the latter two cases. Comparative statics were described, as well. Equilibrium trade barriers are generally decreasing in product differentiation, the competitiveness of domestic firms and the weight on consumer preferences. They are generally increasing in the competitiveness of foreign firms. The only exceptions are when tariff revenue is distributed. The next section turns to a cooperative setting, where two governments negotiate a reduction in tariffs.

Cooperative Bargaining over Trade Policy

We now move to a setting in which the two governments negotiate over trade policies, rather than autonomously and non-cooperatively setting their own trade policies. The problem is treated generally – no specific bargaining procedure is asssumed – but is examined when an international transfer instrument is available. Examination of the case where no transfer instrument is available is relegated to Appendix C. Before this, the first section discusses three sources of gains from negotiations in this particular model: terms-of-trade externalities; externalities associated with intra-industry trade; and, other Pareto inefficiencies.

What Are the Sources of Gains from Trade Negotiations?

Before examining these three justifications, it is worth reiterating that, as a consequence of Lemma 2, the government's utility-maximizing trade policy is unaffected by the trade policy set in the foreign country. As pointed out in Abel-Koch (2010), whose model has a similar feature, this implies that the government in l cannot credibly threaten to retaliate against high trade barriers in h, which generally harm l's exporters, by raising its own trade barriers. Such retaliation would only move the government away from its utility-maximizing trade policy, which is independent of the trade policy set in h.

So where do the gains from cooperative bargaining over trade policy lie? In the standard trade model, which features no intra-industry trade, the answer is unambiguous: terms-of-trade externalities (Grossman and Helpman, 1995*b*; Bagwell and Staiger, 1999; Johnson, 1953). Under the right circumstances, terms-of-trade externalities make a non-zero tariff optimal for an importing country. While imposition of this tariff may be utility-maximizing for the government imposing the tariff, it imposes costs on the foreign, exporting country and world GDP is reduced on net due to the distortionary impact of the tariff. Negotiations can perform two roles then. First, they can eliminate the terms-of-trade motivation for importing countries if the exporting country promises to transfer some of its GDP to the importing country in exchange for reduced tariffs. If the transfers are reasonably efficient, then both countries are better off. Second, trade negotiations can allow countries which import some goods and export others to trade off tariff or trade barrier concessions across their different industries, leaving both sides better off.

As noted in the section on tariff setting, terms-of-trade gains are also present in this model. Due to the presence of intra-industry trade, however, the logic is slightly different than in the standard trade model. With intra-industry trade, consumers in *both* countries would prefer that their own government impose a small positive tariff on imports in the same industry. Will the simultaneous application of tariffs end up reducing consumer welfare on net? Or the utility of the two governments relative to some negotiated agreement?

The answer to the first questions is no. From the perspective of consumers in l, the tariffs imposed by h are irrelevant to their utility. There is therefore no sense in which consumers feel they are trapped in a suboptimal equilibrium even though both countries are taking advantage of terms-of-trade externalities simultaneously. More surprisingly, the answer to the second question is not necessarily yes. Governments can be better off by mutually adopting a positive tariff even though they are both harming one another's exporters through this policy. Appendix A7 demonstrates that for the simple case of two completely symmetric countries, there are circumstances under which both governments do better in terms of maximizing their objective functions with a positive level of tariffs *in both countries* than they would in the open trade equilibrium. This can even happen if governments place no weight whatsoever on the domestic profits of their firms. For example, this is true when the government highly values consumer utility so the 'optimal tariff' demands of consumers outweigh the free trade demands of domestic exporters.

The key implication of this is that trade policy does not necessarily pose a problem of cooperation, where both sides mutually defect from some theoretically government (or consumer) utility-maximizing free trade. This is true even when the domestic profits of firms are absent from the government's objective function. Two important caveats remain, though. First, there will be other circumstances where trade policy determination will have the usual features of a cooperation dilemma. For example, if consumer welfare is relatively unimportant to the government and the size of the industry is small enough, then both sides will lose from increasing tariffs. Second, even if these circumstances do not prevail, the non-cooperative tariff set by governments may not be Pareto efficient, and the sides might be better off negotiating some joint reduction in trade barriers, accompanied by a transfer of wealth, which mutually improves their welfare.

A second incentive for negotiation exists which is highlighted by examination of the NTB case. In setting its optimal level of NTBs non-cooperatively, the government maximizes the following objective function

$$\frac{\epsilon^l L^l}{2\eta}\left(\alpha - c_D^l\right)\left(\alpha - \frac{k+1}{k+2}c_D^l\right) + \frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+2} + \frac{L^h}{\gamma\phi^l}N_e^l(\nu^h)^2\left(\frac{c_D^h}{\nu^h}\right)^{k+2}.$$

Of course, l's trade policy also affects h via its impact on Π_X^h, but from its selfish perspective any negative externalities of its trade policy on h's firms are quite irrelevant. Of course, h's government acts in the same manner and ends up hurting l's firms. Again examining the case where both countries are symmetric and set identical trade policies, the above expression for G^l reduces to

$$\frac{\epsilon^l L}{2\eta}\left(\alpha - c_D\right)\left(\alpha - \frac{k+1}{k+2}c_D\right) + \frac{L}{\eta(k+2)}\left(\alpha c_D - (c_D)^2\right).$$

This is decreasing in ν^l under a wide variety of circumstances. A sufficient condition for this is that $\alpha < 2c_D$. If this is so, then no positive equal increase in trade barriers could be welfare maximizing for the two governments. And yet, we saw that when governments are maximizing separately and non-cooperatively, complete autarky is possible, so clearly this example does have the usual features of a cooperation dilemma[14]. Furthermore, the cooperation problem is not simply driven by some sort of optimal trade barrier argument for consumers, because all of the NTB costs are deadweight loss, and the ideal joint trade policy could still be complete openness even if $\epsilon^l = 0$, under the sufficient condition above. Instead, what creates the result here is that each country is externalizing costs onto foreign firms when it tries to help its own producers. If both governments could commit to refrain from using trade barriers they would both be left better off. Note that this prisoner's dilemma-type form of the game will not hold generally, but the externalities are a general feature of the tariff-setting problem.

This feature of the model can be contrasted with Ossa (2010) which examines a 'production relocation externality'. In that model, governments wish to impose a tariff to induce greater entry in the domestic market, which enhances competition and reduces prices for consumers. This is similar to the logic of the relocation decision of firms in the long-run version of the Melitz and Ottaviano (2008) model. However, in the short-term version of the model which is used here, there is no firm entry and trade barriers only serve to raise, not lower domestic costs. Instead,

[14] To see a case where autarky is possible in the non-cooperative setting when $\alpha < 2c_D$, consider the case where ϵ^l is very low.

what drives the result is that governments mutually take no account of the harm to the profits of their foreign competitors caused by their trade policies. Since both export the same good, both stand to lose given the right circumstances. Intra-industry trade is thus the crucial feature of the economic setting for motivating negotiations over a single industry.

We have now identified three possible problems which can be resolved through trade negotiations. First, when both countries try to take advantage of terms-of-trade externalities to set a non-zero tariff, they might both be left worse off, yet neither can credibly commit to unilaterally reduce tariffs. Second, the countries do not take into account the external effects of trade barriers on one another's exporting firms, and the combination of two myopic governments setting trade policies can leave both sides worse off. Third, non-cooperatively determined trade policies can be Pareto inefficient. Some mutually welfare-enhancing trade deal which is in the interest of both governments (not just both sets of consumers) might be available.

The next subsection examines cooperative equilibria when inter-country transfers of wealth are possible. These transfers open up a huge array of jointly welfare-improving trade deals, and can help to resolve all three of the problems identified above.

Cooperative Equilibria with International Transfers

In this section, it is assumed that the two governments are capable of transferring wealth between them in order to facilitate reaching a Pareto optimal reduction in trade barriers. Internally to the model, this takes the form of either a transfer of the numeraire good or of currency, which amount to the same thing in the utility functions of consumers. Although it is possible to consider transferring income to producers to supplement their profits, this chapter follows the argument originally developed in Grossman and Helpman (1995*b*), in which the international transfer is distributed equally among all consumers in the recipient country. The country which sends the transfer costlessly taxes its consumers, reducing their consumption of the numeraire good to do so. It is assumed throughout that there is enough consumption of the numeraire to enable the transfer to be taxed without altering the consumption of the differentiated good in the sending country. Note also that for similar countries, the transfer payment will be small.[15]

The two governments negotiate over a pair of tariffs or trade barriers, $\{\tau^l, \tau^h\}$ or $\{\nu^l, \nu^h\}$, as well as an amount R of the numeraire (or of currency) to be transferred from one country to the other. A positive R is assumed to imply that h has

[15] A number of different mechanisms for transferring the gains from trade agreements are observed in the real world which provide justification for the assumption that a transfer facility between countries exists. The creation of the common market for the European Economic Community paired a free trade area with an extensive system of agricultural subsidies, paid for at the supranational level but featuring extensive transfers between member countries (Grossman and Helpman, 1995*b*). The European Coal and Steel Community also featured substantial payouts to workers displaced by trade, and loan guarantees to less efficient producers to cushion the blow of intensified competition within Europe (Mathieu, 1970). Less directly, the elaborate 'package deals' which characterize both bilateral and multilateral international trade negotiations provide a means for governments to pair concessions in one area with gains in another (Davis, 2004).

contributed to l, so the updated objective functions of the two governments are

$$G^l = \epsilon^l(L^l U^l + R) + \Pi^l$$

and

$$G^h = \epsilon^h(L^h U^h - R) + \Pi^h.$$

If tariff revenues are earned and redistributed, then an additional term, T^l or T^h, is added to the consumer utility in each of the objective functions.

No specific bargaining procedure will be laid out here. Rather, it is only assumed that any trade policy will be Pareto efficient. Since we have no basis on which to weight the utility of one government over the other, efficiency requires maximizing $\varsigma G^l + (1-\varsigma)G^h$ for any $\varsigma \in [0, 1]$. As originally demonstrated in Grossman and Helpman (1995*b*), this resolves into a simpler form. The problem of maximizing $\varsigma G^l + (1-\varsigma)G^h$ is exactly equivalent to maximizing $\epsilon^h G^l + \epsilon^l G^h$[16].

Recall that in the non-cooperative setting without tariff revenue, the trade policy in l is determined by maximizing $G^l = \epsilon^l L^l U^l + \Pi^l_D$. Under the cooperative setting, τ^l is determined by maximizing $\epsilon^h G^l + \epsilon^l G^h$. Dropping all terms which are independent of τ^l, $\epsilon^h G^l + \epsilon^l G^h$ is proportional to

$$\epsilon^l L^l U^l + \Pi^l_D + \frac{\epsilon^l}{\epsilon^h}\Pi^h_X.$$

[16] To see this, note that the definition of G^h implies that $\epsilon^h R = \epsilon^h L^h U^h + \Pi^h - G^h$. Substituting this into the expression for G^l and rearranging, we find that $\epsilon^h G^l = \epsilon^h \epsilon^l L^l U^l + \epsilon^l \epsilon^h U^h + \epsilon^l \Pi^h - \epsilon^l G^h - \epsilon^h \Pi^l$. Maximizing G^l is therefore equivalent to maximizing $\epsilon^h G^l + \epsilon^l G^h$, provided that R adjusts to facilitate the gains. Using a similar set of steps, it can be shown that maximizing G^h is also equivalent to maximizing $\epsilon^h G^l + \epsilon^l G^h$.

If tariff revenue is included, there is an extra term $\epsilon^l T^l$ added in both non-cooperative and cooperative settings. The only difference between the cooperative and non-cooperative maximization problems is therefore the term $\frac{\epsilon^l}{\epsilon^h}\Pi_X^h$. This makes sense because efficiency from a global perspective requires that the impact on h's exporters be considered when trade policy is determined in l.

Except for the coefficient on the foreign exporter profits terms, this objective function is exactly analagous to the government's objective function in the non-cooperative case where foreign firms are capable of lobbying or multinational firms exist. In the tariff-setting case, the profits of h's exporters are always diminishing in increased tariff rates, so the rate of tariffs will be (weakly) lower in the cooperative equilibrium relative to the non-cooperative equilibrium. In the NTB case, recall that under most circumstances Π^h is diminishing in ν^l, therefore the addition of $\frac{\epsilon^l}{\epsilon^h}\Pi^h$ to the government's objective function will tend to reduce the marginal benefits of trade barriers, and so push down the rate of protection relative to the non-cooperative equilibrium. As discussed previously, the only exceptions to this will occur when the economies would otherwise be open or have relatively low tariffs in the non-cooperative settings, and $\frac{N_e^l}{(m^l)^k}$ is extremely low and $\frac{N_e^h}{(m^h)^k}$ is extremely high. The specific condition for this was that

$$\frac{(\tau^l)^{-k}\frac{N_e^h}{(m^h)^k}}{\frac{N_e^l}{(m^l)^k}(k+1)+\frac{2(k+1)\gamma}{\eta}(c_D^l)^{-k}} > 1.$$

For reasonable parameter values, this condition is only satisfied when there are extreme asymmetries between the two countries.

Proposition 6. *When the two governments set trade policy via some Pareto-efficient bargaining procedure, while employing an international transfer instrument, tariffs are lower* *than they would be in a similar non-cooperative setting. NTBs are lower than they would be as long as h's firms aren't too efficient compared to l's.*

The next step is to examine the comparative statics which we have previously discussed. The NTB case is the most straightforward of the two. Noting again the close analogy between the maximization problem when foreign firms are represented in the government's objective function in a non-cooperative setting, and the cooperative objective function, the first and second comparative statics from Comparative Static 2 translate immediately. The tariff case, when all tariff revenue is lost, is slightly more complex because there are extra conditions for the comparative statics to work as above for the cases of $\frac{N^l}{(m^l)^k}$ and γ. These will hold if ϵ^l isn't too large relative to ϵ^h, and, for example, hold if the two governments value consumer welfare equally.

Comparative Static 3. *When the governments cooperatively set tariffs or non-tariff barriers, using a Pareto efficient bargaining procedure with inter-country transfers, the level of tariffs or trade barriers in l are:*

1. *Decreasing in γ*
2. *Increasing in N_e^l and N_e^h and decreasing in m^l and m^h*
3. *Either increasing or decreasing in ϵ^l, and generally increasing in ϵ^h.*

For the tariff case, points 1 and 2 may not be the case if $\epsilon^l \gg \epsilon^h$.

The explanation for these comparative statics are largely the same as in the case with foreign firm lobbying or multinational corporations. The only significant difference is that tariffs are always increasing in ϵ^h, and non-tariff barriers will increase except under the conditions of Proposition 1. The intuition for this claim is that the trade policy in l only affects the consumers in h via the transfer instrument R. When the government in h places a high weight on consumer welfare, it strongly wishes to keep R small (assuming it is a net transfer to l) and the way to do this is to satisfy l's government with a relatively low rate of trade barriers in both countries. This satisfies l's consumers (and h's!) while buying off l's producers with expanded access in h at the expense of h's own producers, who are relatively less important to the government in h anyway.

As in the non-cooperative case, when tariff revenue is redistributed the comparative statics are generally not analytically tractable, with the exception of a special case described in the footnote[17]. In order to work around this limitation, numerical simulations were again employed the results of which are presented schematically in Table 4.2[18]. The effect of changing the parameters was very similar for all of the parameters, with the exception that N_e^l and m^l have much crisper results which tend to work contrary to the patterns expected from the producer profits and maintaining competition effects. This would seem to be a reflection of the the added force of the Π_X^h term, which as noted in Appendix A5 can push up the equilibrium domestic cutoff as l's firms become more competitive.

[17] When two two governments share the same ϵ and a fraction $\frac{k}{\epsilon(k+1)}$ of tariff revenue is lost, the equilibrium c_D^l is independent of love-of-variety and the Ricardian comparative advantage parameters. This is proven in Appendix A8. The result of this is that only the 'maintaining competition' effects are present, and the comparative statics are as in comparative statics 2 and 3.

[18] A graphical presentation of the simulations is presented in Appendix B.

Table 4.2: This table provides a heuristic account of the forces at work in the cooperative tariff-setting problem with redistribution, and reports the proportion of each simulated comparative static that was *negative*. Two stylized equations help with the interpretation: 1. The Domestic Profits Effect + Tariff Revenue Effect = Δc_D^l 2. Δc_D^l+ The Maintaining Competition Effect = $\Delta\tau^l$. For example, an increase N^l can push c_D^l up or down because the DP and TR effects are contradictory, although the simulations suggest that the TR effect was always dominant and c_D^l is decreasing in N^l. The MC effect, which pushes τ^l up, generally did not do so enough to compensate for the TR effect.

	MC Effect	DP Effect	TR Effect	$\Delta\tau^l$	$\Pr(\Delta\tau^l < 0)$	Δc_D^l	$\Pr(\Delta c_D^l < 0)$
γ	$-$	$-$	$+$	$-$	.96	$+$	0
N^l	$+$	$+$	$-$	$-$	.87	$-$	1
N^h	$+$	0	$-$	$+$	.01	$-$	1
m^l	$-$	$-$	$+$	$+$	.16	$+$	0
m^h	$-$	0	$+$	$-$	.94	$+$	0
ϵ^l	0	$-$	$+$	$-$	1	$-$	1

Cooperative Equilibria without International Transfers

Analytical evaluation of the model is generally not available without an international transfer instrument. Appendix C discusses the problem, and presents some numerical simulations for the comparative statics.

This section of the chapter has described the nature of the cooperative trade barrier determination problem encountered by two governments negotiating a bilateral liberalization of trade. The first subsection demonstrated that there are three sources of gains from trade negotiations, arising from terms-of-trade externalities, general Pareto inefficiencies that can be resolved with a transfer instrument, and a specific Pareto inefficiency that results from simultaneous protection in industries with intra-industry trade. The next subsection then explored trade negotiations when a transfer instrument is available to smooth negotiations. Equilibrium trade barriers were, again, generally decreasing in love-of-variety; increasing in foreign market competitiveness; and decreasing in the weight of consumers in the government's utility function.

Conclusion

This chapter concludes by exploring in greater detail the broader contribution of this chapter to the literature on trade politics. Two themes are emphasized. Integrating two recent revolutions in international trade – on the extent of intra-industry trade and variation in firm export performance – into a model of trade politics has important implications for understanding how trade policy is made. This holds in both cooperative and non-cooperative settings, although the former especially highlight disagreements among firms. Second, many of the results highlight the complex interactions between economic and institutional factors in determining the outcomes of the trade policy process.

Incorporating firm heterogeneity and intra-industry trade into trade politics

The most significant contribution of this work is to incorporate intra-industry trade and firm heterogeneity into a model of tariff determination. The foundational literature on the politics of trade policy largely operates within the neat economic divisions of the standard trade model. For any given product, countries are either an importer or an exporter *only*, and setting a trade policy amounts to determining a level of import tariffs or export subsidies, depending on the industry's comparative advantage. The firms which make up these industries are interchangeable, sharing the same preferences and political commitments, regardless of size, competitiveness, and engagement in world markets. These assumptions contradict two revolutions in the study of international trade, one longstanding and the other more recent.

The first revolution concerns the extent to which trade in goods flows between countries *in the same industry*. This 'intra-industry trade', where countries both import and export goods in the same product category even at relatively fine levels of aggregation, was first extensively documented in the 1970's. Intra-industry trade for an industry in a given country is usually measured as the overlap in value between exports and imports. While estimates vary depending on the methodology and data sources, it is generally thought that this overlap between imports and exports of the same product amount to between 25 and 50% of all trade flows for most OECD and upper middle-income countries, and significantly higher proportions of the trade in manufactured goods[19]. The overlap of trade volumes also understates the importance of intra-industry trade for trade politics, because even industries

[19] On the measurement of intra-industry trade see Grubel and Lloyd (1971) and Grubel and Lloyd (1975). Brülhart (2009), OECD (2002) and Bergsten and Noland (1993) discuss the extent of intra-industry trade across industries. Intra-industry trade is most often explained as a consequence of product differentiation, either because each consumer prefers to consume a variegated basket of the same goods or because taste varies across consumers (Dixit and Stiglitz, 1977; Helpman and Krugman, 1985; Krugman, 1980). This chapter employs a model with the former approach, assuming that consumers have an intrinsic 'love-of-variety' which leads them to fragment consumption across varieties of essentially the same product. In this model, as well as empirically, this taste for variety varies across products and industries. This is true at a very coarse level – some industries have virtually no product differentiation and some do – and at a finer level. For example, manufacturing industries differ quite substantially in their levels of intra-industry trade, and higher technology goods tend to feature greater intra-industry trade (Brülhart, 2009).

with unequal levels of imports and exports will have significantly different political dynamics than industries with no intra-industry trade whatsoever.

Krugman (1981) is among the earliest work to explore the political implications of intra-industry trade. It posits that the enormous reduction in trade barriers between rich countries in most of their manufacturing industries occurred because these countries are relatively similar in their endowments and their trade is largely intra-industry in character. Under these circumstances, trade liberalization induces relatively modest changes in factor incomes but generates substantial improvements in product variety and industry efficiency. Under these circumstances, trade liberalization might be relatively uncontroversial (Alt et al., 1996)[20]. Gilligan (1997) and Bombardini (2008) offer a contrasting perspective, arguing that product differentiation gives rise to lobbying for firm-specific protection, and may actually make trade liberalization harder by eliminating the collective action problem of industry-wide organizing for protection.

This chapter develops a model of trade politics where each country is both an importer and exporter of a differentiated good, and follows the first approach, assuming that trade protection is a public good for firms producing a differentiated product in the same industries. Rather than adopting a multi-factor economy and closely examining changes in factor rewards, the approach here is essentially Ricardian in nature, with a single factor of production, labor, and technology differences between countries. This permits a direct focus direct on the conflict between con-

[20] Although less focused on politics, Bernard, Redding and Schott (2008) develop a similar argument in a two-factor market which also features firm heterogeneity.

sumers (whose wage is not affected by trade due to the inclusion of a numeraire good) and producers in industries with intra-industry trade. A number of consequences of intra-industry trade trade are explored in detail.

First, when both countries import the same good, both have an incentive to engage in trade protection of their industry. This straightforward consequence of intra-industry trade provides a simple explanation of the widespread existence of competing trade barriers among trade partners in the same industry. Of course, the extent of protection depends strongly on the size and strength of the given industry. As explained below, small or inefficient industries will generally be *less able* to secure substantial protection, while two countries which feature a relatively robust industry may therefore have quite high levels of trade barriers. Relatively equal levels of competitiveness in the production of a good are thus no guarantee of relatively open borders.

Second, and more in congruence with Krugman (1981), both tariffs and non-tariff barriers to trade are generally decreasing in love-of-variety, the key driver of intra-industry trade. This occurs for two reasons. As love-of-variety increases, the increase in profits for firms from additional trade protection are generally diminishing, weakening their claims to greater trade protection from the government vis-a-vis consumers. This occurs because consumers purchase less of any given variety as their desire for differentiation increases. Even as firms are less able to make their voices heard, consumers are more strident in their demand for reduced barriers to trade. Elimination of trade barriers improves the level of competition in the home market, reducing average prices and increasing the available variety of products.

Third, the introduction of intra-industry trade establishes a new explanation for bilateral trade negotiations on trade barriers, and one which can explain negotiations over trade barriers *in a single industry*. In the standard trade model, terms of trade externalities provide the only possible rationale for trade negotiations, because if each state tries to take advantage of its market power over imports, all are left worse off (Grossman and Helpman, 1995*b*; Johnson, 1953; Bagwell and Staiger, 1999). Rather than relying on terms of trade externalities, intra-industry trade in this model raises the possibility of negative externalities imposed on each countries' exporting firms at the same time and in the same industry. Failure to take account of the external effect of one's trade barriers then leads to Pareto suboptimal levels of barriers to trade, which can only be resolved at the negotiating table. Trade policy determination in a single industry therefore can take the form of a Prisoner's dilemma, however in a quite different setting then a single firm monopolizing production in each country, as explored in Brander and Spencer (1984)[21].

The second, and more recent, revolution in the economics of international trade concerns the performance of individual firms in export markets. This literature is by now quite extensive, but a few stylized facts will help to justify the model presented below, and explain some of the results. First, in almost all industries which

[21] In identifying this alternative explanation of trade negotiations, this chapter resembles Ossa (2010), although that argument relies on gains to consumers arising from trade-barrier induced relocation of firms, while the motives for protection in this model are strictly to improve the profits of domestic producers. When both governments give in to the demands of their own firms, both may be left worse off.

feature international trade, only a subset of firms actually engage in exporting. For example, even in industries which are net exporters in the United States, usually less than 50% of firms export (Aw, Chung and Roberts, 2000; Bernard et al., 2007). Second, exporters are generally more productive than non-exporters (Bernard and Jensen, 2004). More productive firms sell their varieties for lower prices and are therefore the only firms able to earn positive profits abroad after all costs of trade have been factored into a firm's cost and pricing structure. Third, decreases in trade barriers generally result in substantial redistribution of production within industries. Firms which are capable of profitably exporting expand, while those which serve only the domestic market produce less or are forced out of production entirely (Pavcnik, 2002; Tybout, 2003).

A number of the results contained in this chapter touch directly on the issues raised by variation in performance at the level of the firm. At the most fundamental level, firm differentiation in exporting means that all firms have a stake in lobbying for protection of the domestic market, but only a subset of firms will lobby for the opening of foreign markets. In the simplest non-cooperative tariff determination settings, all firms have the same preferences over trade policy, preferring their own government to raise trade barriers. In cooperative settings, the more productive, exporting firms may support compromising on barriers at home in order to gain more access abroad, while firms which produce only for the domestic market will be uniformly opposed to liberalization. These differences also arise in non-cooperative settings when it is possible for foreign firms to lobby the government of their export market directly.

Second, both the number and average productivity of firms, the key determinants of comparative advantage in this Ricardian model, strongly influence the level of barriers to trade in political equilibrium. Examining the case of domestic firms lobbying for greater protection, two channels are particularly important. First, when the domestic sector has more firms and those firms are on average more productive, the gains to the industry from protection are greater. This may seem counterintuitive (wouldn't a more competitive industry need *less* protection?) but the 'size factor' generally outweighs the 'global competition' factor. More big domestic firms mean more winners from restricting competition and so greater gains for the industry from trade barriers, even when the fact that foreign competition will diminish is taken into account. Second, consumers are generally more forgiving of trade restrictions when the domestic industry is larger. In the model, consumers demand a certain level of competitiveness in the domestic market. If the domestic industry is small and inefficient, then this must be achieved through low tariffs. If the domestic industry is large and productive, consumers can secure their desired bundle of goods in spite of higher barriers to trade, and so will accept a less open economy.

The competitiveness of foreign firms turns out to have a slightly more complex role in the model. Generally, tariffs and trade barriers are increasing in the competitiveness of the foreign firms, which seems predictable enough but will require careful explanation. For now, a brief discussion of a special case – NTBs where foreign firms are capable of lobbying their export market's government for a reduction in trade barriers – helps to illustrate the role that firm performance plays in the model. First of all, no foreign firms which are incapable of exporting will have an incentive to lobby, so the industry is at cross-purposes on where to devote lobbying resources. But even among potential exporters there is a disagreement between the most productive and the least productive firms. While exporters benefit from a reduction in their prices brought about by reduced trade costs, it turns out that the most productive exporters can gain from a small positive level of trade barriers because these have a minimal impact on their competitiveness while restricting entry of their compatriot firms. In the model, these two effects exactly cancel each other out so it turns out that the only effect of foreign competitiveness on equilibrium NTB rates operates through the jockeying between the export market's consumers and producers. In the end, it is the extra demands from domestic firms which win out and force the government to raise barriers when foreign firms' get more competitive, even if foreign firms enter the government's objective function.

A third and final point on firms concerns the development of an original argument in this chapter hinted at above: under certain circumstances, the total profits of foreign exporting firms may be maximized by a small, *positive* level of non-tariff barriers in their export market[22]. This surprising finding is an 'optimal trade barrier' argument for exporters. This again involves a conflict between the most productive and the least productive firms. The most productive firms are relatively unaffected by a small increase in trade barriers (as long as it is multiplicative of their marginal cost, as in this model) while less productive firms find trade barriers more injurious. Thus, for the most productive firms, a small increase in trade barri-

[22] The equivalent statement about tariffs is not true, however

ers can reduce competition in the foreign market from their compatriot firms which is sufficient to increase their own profits despite the fact that their own production costs (and prices) have increased. The precise conditions under which foreign exporters will benefit in the aggregate from positive trade barriers are described in detail in the chapter.

Political and economic determinants of trade policy

This chapter is an in depth exploration of the clash of interests between consumers and producers, and the at times conflicting interests of producers *within the same industry*. One key theme which emerges from this is that the nature of these disputes is highly contextual and can vary considerably depending on the institutional, political and economic circumstances of trade policy determination. Moreover, these different contextual features interact in interesting and important ways. A key goal of the chapter is therefore to derive comparative statics which link the crucial features of the industries and the political setting to equilibrium levels of trade barriers.

One set of comparative statics involve coarse institutional differences. At the domestic level, tariffs and trade barriers are generally decreasing in the relative weight the government places on consumers interests relative to producer interests. However, this is not necessarily the case when tariff revenue is distributed, because consumers can benefit from tariff revenue and improvements in the terms of trade. Similarly, if foreign firms are permitted to lobby than trade tariffs and trade barriers will generally be lower, except under the circumstances when productive foreign producers prefer trade barriers to block their fellow competitors. Both of these results highlight how institutional features interact with economic features, in this case choice of policy instrument.

At the international level, trade barriers are generally lower in the wake of co-operative negotiations than they would be under the equivalent non-cooperative setting. International negotiations, however, unleash a new set of conflicts among domestic producers, creating an alliance between consumers and the most productive firms against less productive firms incapable of benefitting from trade liberalization. In non-cooperative settings the battle lines are more clearly delineated: firms want protection and consumers do not.

The chapter also focuses on a number of comparative statics which connect features of the industries to equilibrium levels of trade barriers. Most importantly, restrictions on trade are shown to be generally decreasing in consumer love-of-variety, which is usually considered the key driver of intra-industry trade. Product differentiation is a fundamental feature of industries (and one that varies considerably across goods) but its impact on trade politics is not well understood. This work sheds light on this basic determinant of market structure and trade patterns. The links between tariffs and industry competitiveness in the production of a differentiated product are also explored. In general, trade barriers are increasing in the productivity and number of foreign competitors, while the relationship with the competitiveness of domestic firms depends importantly on whether tariffs or trade barriers are employed for reasons which will be discussed.

This chapter explores settings with both an *ad valorem* tariff and a variable cost-of-trade, and a number of striking contrasts emerge depending on the trade policy instrument. Tariff revenues can be redistributed which gives consumers a stake in trade protection; NTBs are generally assumed to be deadweight loss and therefore consumers will always resist their imposition. As noted above, exporting firms always oppose tariff increases in their export markets, but the most productive firms can actually benefit from an increase in non-tariff barriers to trade, creating splits among firms over lobbying abroad and cooperative trade liberalization. The examination of both types of trade policies is particularly important given the continuing prevalence of both tariff and non-tariff barriers to trade, although by now the latter outweigh the former (Kee, Nicita and Olarreaga, 2009).

Appendix A: Proofs

A1: c_X^h is Decreasing in τ^l and or ν^l

The implicit definition of c_X^l is

$$\frac{\alpha - \tau^l c_X^h}{(\tau^l c_X^h)^{k+1}} = \frac{\eta}{2(k+1)\gamma}\left(\frac{N_e^l}{(m^l)^k} + (\tau^l)^{-k}\frac{N_e^h}{(m^h)^k}\right).$$

Using the implicit function theorem, the numerator of $\frac{\partial c_X^h}{\partial \tau^l}$ is

$$\begin{aligned}
&= \frac{-c_X^h}{\left(\tau^l c_X^h\right)^{k+1}} - \frac{\alpha - \tau^l c_X^h}{(\tau^l c_X^h)^{k+2}}(k+1)c_X^h + \frac{\eta}{2(k+1)\gamma}\left((\tau^l)^{-k-1}\frac{N_e^h}{(m^h)^k}\right)\frac{k}{\tau^l} \\
&= \frac{-c_X^h}{\left(\tau^l c_X^h\right)^{k+1}} - \frac{\alpha - \tau^l c_X^h}{(\tau^l c_X^h)^{k+2}}(k+1)c_X^h + \left(\frac{\alpha - \tau^l c_X^h}{(\tau^l c_X^h)^{k+1}} - \frac{\eta}{2(k+1)\gamma}\frac{N_e^l}{(m^l)^k}\right)\frac{k}{\tau^l} \\
&< 0.
\end{aligned}$$

The denominator is also negative on its own. Due to the additional negative sign in front of the fraction, the overall sign of the derivative is negative. The proof is identical for ν^l except all τ^l are replaced with ν^l.

In addition, note two extra features.

$$\frac{\partial^2 c_X^h}{\partial \tau^l \partial \frac{N_e^h}{(m^h)^k}} > 0$$

and

$$\frac{\partial^2 c_X^h}{\partial \tau^l \partial \frac{N_e^l}{(m^l)^k}} < 0.$$

Similarly,

$$\frac{\partial^2 c_D^l}{\partial \tau^l \partial \frac{N_e^h}{(m^h)^k}} > 0$$

and

$$\frac{\partial^2 c_D^l}{\partial \tau^l \partial \frac{N_e^l}{(m^l)^k}} < 0.$$

A2: Conditions under which Foreign Firms Prefer Positive NTBs/Tariffs

In the case of NTBs, foreign profits in l can be rewritten as:

$$\Pi_X^h = -\frac{L^l}{\gamma\phi^l} N_e^l (c_D^l)^{k+2} + \frac{L^l}{\eta(k+2)} \left(\alpha c_D^l - (c_D^l)^2\right).$$

The derivative of foreign profits with respect to c_D^l is

$$\begin{aligned} \frac{\partial \Pi_X^h}{\partial c_D^l} &= -\frac{L^l}{\gamma\phi^l} N_e^l (c_D^l)^{k+1}(k+2) + \frac{L^l}{\eta(k+2)} \left(\alpha - 2(c_D^l)\right) \\ &\propto -\frac{N_e^l}{(m^l)^k}(k+1)(c_D^l)^{k+1} + (\nu^l)^{-k}\frac{N_e^h}{(m^h)^k}(c_D^l)^{k+1} - \frac{2(k+1)\gamma}{\eta}(c_D^l) \end{aligned}$$

The second line follows by subbing out $\alpha - c_D^l$ using the implicit definition of c_D^l, and then simplifying and dividing by all constants. Clearly, when $\nu^l = \infty$ this will be negative, but as $\nu^l \to 1$ it will be monotonically increasing. We wish to know if it will turn positive at some $\nu^l \geq 1$, and in particular at $\nu^l = 1$. It turns out that it will depend crucially on the values $\frac{N_e^l}{(m^l)^k}$ and $\frac{N_e^h}{(m^h)^k}$ and it will be useful to take these in turn.

Dealing with $\frac{N_e^h}{(m^h)^k}$ first, a necessary and sufficient condition for $\frac{\partial \Pi_X^h}{\partial c_D^l} > 0$ in the vicinity of $\nu^l = 1$ is

$$\frac{\frac{N_e^h}{(m^h)^k}}{\frac{N_e^l}{(m^l)^k}(k+1) + \frac{2(k+1)\gamma}{\eta}(c_D^l)^{-k}} > 1.$$

As $\frac{N_e^h}{(m^h)^k} \to 0$ this will clearly not be satisfied for any positive $\frac{N_e^l}{(m^l)^k}$, so we will examine increases in h's competitiveness. Both the top and the bottom approach ∞ in the limit as $\frac{N_e^h}{(m^h)^k} \to \infty$ so we can use L'Hôpital's rule to find the limiting value. After taking the derivatives and simplifying, the condition becomes

$$\frac{\alpha}{c_D^l}\frac{k+1}{k} - 1 > 1$$

which is satisfied as $\frac{N_e^h}{(m^h)^k} \to \infty$ because $c_D^l \to 0$.

Now taking up $\frac{N_e^l}{(m^l)^k}$, as this quantity declines all of the negative terms in the condition for $\frac{\partial \Pi_X^h}{\partial c_D^l} > 0$ will shrink towards zero, however the third term will not do so completely so we again require that $\frac{N_e^h}{(m^h)^k}$ be big enough. Still, as $\frac{N_e^h}{(m^h)^k}$ gets larger, a larger $\frac{N_e^l}{(m^l)^k}$ will suffice to turn $\frac{\partial \Pi_X^h}{\partial c_D^l}$ positive in the region of $\tau^l = 1$.

Now let's quickly identify the comparative statics for Lemma 2. Recall that

$$\frac{\partial \Pi_X^h}{\partial c_D^l} = -\frac{L^l}{\gamma \phi^l} N_e^l (c_D^l)^{k+1}(k+2) + \frac{L^l}{\eta(k+2)}\left(\alpha - 2(c_D^l)\right).$$

On inspection, it is the case that the marginal change in profits for h's exporters wrought by an increase in c_D^l is increasing in γ, decreasing in $\frac{N_e^l}{m^l}$, and independent of $\frac{N_e^h}{m^h}$.

Turning to the tariff case, the expression for aggregate profits in h from exporting is

$$\Pi_X^h = \frac{L^l}{\gamma \phi^h} N_e^h (\tau^l)^{-k-1} (c_D^l)^{k+2}.$$

If the derivative of this with respect to c_D^l is positive at any point, then h's exporters firms can gain from a less open market in l. After simplifying the expression for $\frac{\partial \Pi_X^h}{\partial c_D^l}$, we have

$$\begin{aligned}
\frac{\partial \Pi_X^h}{\partial c_D^l} &= -(k+1)\frac{L^l}{\gamma\phi^h}N_e^h(\tau^l)^{-k-2}(c_D^l)^{k+2}\frac{\partial \tau^l}{\partial c_D^l} + (k+2)\frac{L^l}{\gamma\phi^h}N_e^h(\tau^l)^{-k-1}(c_D^l)^{k+1} \\
&\propto -\frac{k+1}{k}(\tau^l)^{-1}(c_D^l)^{k+2}\left(\frac{(m^h)^k}{N_e^h}\frac{2(k+1)\gamma}{\eta}\left(\frac{c_D^l}{(c_D^l)^{k+2}} + (k+1)\frac{\alpha - c_D^l}{(c_D^l)^{k+2}}\right)\right) + \\
&\quad (k+2)(\tau^l)^{-k-1}(c_D^l)^{k+1} \\
&\propto -\frac{k+1}{k}(\tau^l)^{-1}\left(\frac{2(k+1)\gamma}{\eta}\left(\alpha k + \alpha - kc_D^l\right)\right) + \\
&\quad \frac{k+2}{k}(\tau^l)^{-1}\left(\frac{2(k+1)\gamma}{\eta}k(\alpha - c_D^l) - \frac{N_e^l}{(m^l)^k}k(c_D^l)^{k+1}\right) \\
&= -\frac{1}{k\tau^l}\left(\frac{2(k+1)\gamma}{\eta}(\alpha + kc_D^l)\right) - \frac{k+2}{k\tau^l}\left(\frac{N_e^l}{(m^l)^k}k(c_D^l)^{k+1}\right) \\
&< 0.
\end{aligned}$$

We can also examine the expression for the profits of an individual firm operating in h and exporting to l. An exporter from h to l with marginal cost c earns $\frac{L^l}{4\gamma}(\tau^l)(c_X^l - c)^2$. Because c_X^l is decreasing in τ^l there are clearly direct benefits and indirect costs associated with higher c_X^l. Furthermore, the indirect costs, which operate via c_X^l will be lowest for the most productive firm, with $c = 0$. The derivative of this firm's profits with respect to c_D^l is

$$\begin{aligned}
\frac{\partial \pi_X^h(c=0)}{\partial c_D^l} &= -\frac{L^l}{4\gamma}(c_X^h)^2\frac{\partial \tau^l}{\partial c_D^l} + \frac{2L^l}{4\gamma}c_X^h \\
&\propto -\frac{1}{4}\left(\tau^l\right)^{k+1}\left(\frac{(m^h)^k}{N_e^h}\frac{2(k+1)\gamma}{\eta}\left(\frac{c_D^l}{(c_D^l)^{k+2}} + (k+1)\frac{\alpha - c_D^l}{(c_D^l)^{k+2}}\right)\right) + \frac{1}{2}\frac{\tau^l}{c_D^l} \\
&= \frac{1}{4}\left(\frac{2(k+1)\gamma}{\eta}\left(\frac{-\alpha k - \alpha + kc_D^l}{(c_D^l)^{k+2}}\right)\right) + \\
&\quad \frac{1}{4}\left(\frac{2(k+1)\gamma}{\eta}\frac{2(\alpha - c_D^l)}{(c_D^l)^{k+2}} - \frac{N_e^l}{(m^l)^k}\frac{2}{c_D^l}\right)
\end{aligned}$$

A sufficient condition for this to be negative is $(k-2)(c_D^l - \alpha) - \alpha < 0$. We know from the definition of c_D^l that $c_D^l - \alpha < 0$, so we only need to consider cases where $k < 2$.

We have assumed that $k \geq 1$ and this expression at $k = 1$, where it is minimized, is $-c_D^l < 0$. Therefore, no exporters in h benefits from an increase in tariffs in l.

A3: Comparative statics for marginal tariff revenue increase

Here is a useful decomposition of the expression for tariff revenue is introduced for the first time.

$$
\begin{aligned}
\frac{1}{k+1}T^l &= \frac{\tau^l - 1}{(\tau^l)^{k+1}}\frac{L^l}{\gamma\phi^h}N_e^h\left(c_D^l\right)^{k+2} \\
&= (\tau^l)^{-k}\frac{L^l}{\gamma\phi^h}N_e^h\left(c_D^l\right)^{k+2} - \frac{L^l}{\gamma\phi^h}N_e^h\tau^l\left(\frac{c_D^l}{\tau^l}\right)^{k+2} \\
&= \frac{L^l}{\gamma\phi^h}N_e^h\left(\frac{(m^h)^k}{N_e^h}\left(\frac{2(k+1)\gamma}{\eta}\frac{\alpha - c_D^l}{(c_D^l)^{k+1}} - \frac{N_e^l}{(m^l)^k}\right)\right)\left(c_D^l\right)^{k+2} - \Pi_X^h \\
&= \frac{L^l}{\eta(k+2)}\left(\alpha - c_D^l\right)c_D^l - \Pi_D^l - \Pi_X^h
\end{aligned}
$$

$\Pi_D^l = \frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+2}$ is clearly increasing in c_D^l (i.e. increasing in τ^l).

$$
\begin{aligned}
\Pi_X^h &= \frac{L^l}{\gamma\phi^h}N_e^h(\tau^l)^{-k-1}(c_D^l)^{k+2} \\
&= \frac{L^l}{2(k+1)(k+2)\gamma}\left(\frac{m^h}{N_e^h}\right)^{\frac{1}{k}}\left(\frac{2(k+1)\gamma}{\eta}\frac{\alpha - c_D^l}{(c_D^l)^{\frac{k+1}{k}}} - \frac{N_e^l}{(m^l)^k}(c_D^l)^{\frac{k^2+k}{k+1}}\right)^{\frac{k+1}{k}}
\end{aligned}
$$

This expression is decreasing in c_D^l.

Using these expressions, two of the comparative statics are immediate. The marginal benefit of a small increase in c_D^l, for some particular c_D^l, is decreasing in N_e^h and increasing in m^h. In words, as the differentiated product industry in h gets more competitive, the largest gains from increasing tariffs come at lower levels of tariffs.

The marginal benefit of an increase in c^l_D will be decreasing in N^l_e and increasing in m^l as long as the following condition holds:

$$\frac{\partial^2 \Pi^l_D}{\partial c^l_D \partial \frac{N^l_e}{(m^l)^k}} + \frac{\partial^2 \Pi^h_X}{\partial c^l_D \partial \frac{N^l_e}{(m^l)^k}} > 0.$$

The expression on the left hand term is positive, because the gains from protection for aggregate domestic profits are increasing in industry size and productivity. The second term is negative because the losses for h's firms from additional protection in l are increasing in the size and efficiency of l firms. There is therefore some ambiguity here, however note that as long as h's firms are reasonably numerous and efficient the condition will be met. Examination of some numerical examples suggests that this condition is generally reasonable. It also can be restated in terms that suggest its plausibility: as l's firms get more productive, it must be the case that the marginal benefits to less competition in l for l's domestic firms increase more than the marginal costs to h's exporters decrease.

Finally, the marginal benefit of an increase in c^l_D will be increasing in γ as long as

$$\frac{\partial^2 \Pi^l_D}{\partial c^l_D \partial \gamma} + \frac{\partial^2 \Pi^h_X}{\partial c^l_D \partial \gamma} < 0.$$

The left hand term is always negative, while the right hand term is ambiguous. Again, it is not clear if the condition will be satisfied but it will, for example, if h's firms are fairly competitive, and numerical examples suggest that this condition is generally reasonable. Again restating the condition in words, it requires that as consumer love-of-variety increases, the marginal benefits from less competition in l for l's domestic firms must decrease more than the marginal gains for h's exporters increase.

A4: No Interior Solutions when Revenue is Lost

The first order condition for the government's maximization problem is

$$\frac{\partial G^l}{\partial c_D^l} = \epsilon^l L^l \left(-\alpha - \frac{k+1}{k+2} + 2\frac{k+1}{k+2}c_D^l\right) + (k+2)\frac{L^l}{\gamma\phi^l}\bar{N}_e^l(c_D^l)^{k+1} = 0.$$

The second order condition is

$$2\epsilon^l L^l(\frac{k+1}{k+2}) + (k+2)(k+1)\frac{L^l}{\gamma\phi^l}\bar{N}_e^l(c_D^l)^k$$

This is clearly positive across the feasible range of cutoffs, so there is no interior solution.

A5: Foreign Profits Included in Objective Function

I will first go into detail on the NTB case. The government's objective function, dropping all terms which are not a function of c_D^l, is

$$\begin{aligned}
G^l &= \epsilon^l U^l + \Pi^l + \beta\Pi^h \\
&= \frac{\epsilon^l L^l}{2\eta}\left(\alpha - c_D^l\right)\left(\alpha - \frac{k+1}{k+2}c_D^l\right) + \frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+2} + \beta\frac{L^l}{\gamma\phi^h}N_e^h(\nu^l)^2\left(\frac{c_D^l}{\nu^l}\right)^{k+2} \\
&= \frac{\epsilon^l L^l}{2\eta}\left(\alpha - c_D^l\right)\left(\alpha - \frac{k+1}{k+2}c_D^l\right) + \frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+2} + \\
&\quad \beta\frac{L^l}{\gamma\phi^h}N_e^h\left(\frac{(m^h)^k}{N_e^h}\left(\frac{2(k+1)\gamma}{\eta}\frac{\alpha - c_D^l}{(c_D^l)^{k+1}} - \frac{N_e^l}{(m^l)^k}\right)\right)\left(c_D^l\right)^{k+2} \\
&= \frac{\epsilon^l L^l}{2\eta}\left(-\frac{2k+3}{k+2}\alpha c_D^l + \frac{k+1}{k+2}(c_D^l)^2\right) + (1-\beta)\frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+2} + \\
&\quad \beta\frac{L^l}{\eta(k+2)}\left(\alpha c_D^l - (c_D^l)^2\right) \\
&= \left(-\frac{\epsilon^l L^l}{2\eta}\frac{2k+3}{k+2}\alpha + \frac{\alpha\beta L^l}{\eta(k+2)}\right)c_D^l + \left(\frac{\epsilon^l L^l}{2\eta}\frac{k+1}{k+2} - \frac{\beta L^l}{\eta(k+2)}\right)(c_D^l)^2 + \\
&\quad (1-\beta)\frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+2}
\end{aligned}$$

First, recall that the government's choice of cutoff is bounded between $c_D^l(\tau^l = 0)$ and $c_D^l(\tau^l = \infty)$. The first order condition requires that

$$\left(-\frac{\epsilon^l L^l}{2\eta}\frac{2k+3}{k+2}\alpha + \frac{\alpha\beta L^l}{\eta(k+2)}\right) + \left(\frac{\epsilon^l L^l}{2\eta}\frac{k+1}{k+2} - \frac{\beta L^l}{\eta(k+2)}\right)2c_D^l + (1-\beta)\frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+1}(k+2) = 0.$$

The second-order condition for this problem is

$$-2\left(\frac{\epsilon^l L^l}{2\eta}\frac{k+1}{k+2} - \frac{\beta L^l}{\eta(k+2)}\right) > (1-\beta)\frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^k(k+2)(k+1).$$

One useful necessary condition for this to hold is that $\beta > \frac{\epsilon^l(k+1)}{2}$. Foreign profits, which are the only source of a negative second derivative here, must be important enough in the government's objective function to generate an interior solution.

In order to proceed with the comparative statics, it helps to consider what the requirement for the second order condition implies. The government here is equalizing the marginal losses in the first two terms and marginal benefits in the third term. The second order condition requires that at any maximum, the absolute value of the slope of the marginal costs curve be greater than the slope of the marginal benefits curve. Now consider reducing the coefficient in front of $(c_D^L)^{k+2}$ slightly. The effect of this is to push down the marginal benefits curve, and because its slope is less than that of the absolute value of the marginal costs curve, this reduces the optimal c_D^l.

Using this approach, we can now examine the objective function to determine comparative statics for c_D^l. On inspection, it will be larger if γ is smaller, N_e^l is larger, and m^l is smaller because each of these changes increase the weight on the third term. The optimal c_D^l does not depend on N_e^h and m^h. Using the implicit function theorem, the optimal c_D^l will be decreasing in β as long as $\frac{\alpha}{\eta(k+2)} - \frac{2c_D^l}{\eta(k+2)} -$

$\frac{L^l}{\gamma\phi^l} N_e^l (c_D^l)^{k+1} \frac{1}{k+2} < 0$. There are a variety of conditions which suffice for $\frac{\partial c_D^l}{\partial \beta}$ to be negative, but perhaps the most instructive is the following: $\frac{R_D^l}{k+2} > 1$. In words, the total revenue from domestic sales of all firms in l, divided by $k+2$ (which is always greater than 3 but generally not too large) must be greater than the wage of a single worker. This makes clear that under most reasonable circumstances, $\frac{\partial c_D^l}{\partial \beta} < 0$. Deriving this condition makes use of the requirement that $\frac{(\alpha - c_D^l) c_D^l (k+1)}{\eta(k+2)}$, which is the spending on varieties per consumer, must be less than the wage, which is one. Finally, the sign of $\frac{\partial c_D^l}{\partial \epsilon^l}$ is negative if $(2k+3)\alpha < (2k+2)$ and is therefore ambiguous.

With these comparative statics in hand, it is possible to determine how the optimal NTB rates vary with the parameters using the definition

$$\nu^l = \left(\frac{(m^h)^k}{N_e^h} \left(\frac{2(k+1)\gamma}{\eta} \frac{\alpha - c_D^l}{(c_D^l)^{k+1}} - \frac{N_e^l}{(m^l)^k} \right) \right)^{-\frac{1}{k}} .$$

As an example, note that increases in γ will both directly reduce ν^l and indirectly reduce ν^l, via a reduction in c_D^l. Using a similar logic, ν^l will be increasing in N_e^l and N_e^l and decreasing in m^l and m^h. ν^l is only a function β via c_D^l, which is generally decreasing in β, which means ν^l is generally decreasing in β, too.

The tariff case proceeds with a few differences. The government's objective function is now

$$\begin{aligned} G^l &= \epsilon^l U^l + \Pi_D^l + \beta \Pi_X^h \\ &= \frac{\epsilon^l L^l}{2\eta} \left(\alpha - c_D^l\right) \left(\alpha - \frac{k+1}{k+2} c_D^l \right) + \frac{L^l}{\gamma\phi^l} N_e^l (c_D^l)^{k+2} + \beta \frac{L^l}{\gamma\phi^h} N_e^h (\tau^l)^{-k-1} \left(c_D^l\right)^{k+2} \end{aligned}$$

Using the same steps as in Appendix A2, we have

$$\begin{aligned}\frac{\partial \Pi_X^h}{\partial c_D^l} &= \frac{L^l}{2\gamma(k+1)(k+2)}\left(-\frac{1}{k\tau^l}\left(\frac{2(k+1)\gamma}{\eta}(\alpha+kc_D^l)\right)-\frac{k+2}{k\tau^l}\left(\frac{N_e^l}{(m^l)^k}k(c_D^l)^{k+1}\right)\right)\\ &= -\frac{1}{k\tau^l}\left(\frac{L^l}{\eta(k+2)}(\alpha+kc_D^l)\right)-\frac{k+2}{\tau^l}\left(\frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+1}\right)\end{aligned}$$

Note that the final terms is equal to $-\frac{1}{\tau^l}\frac{\partial \Pi_D^l}{\partial c_D^l}$.

The marginal cost of an increase in competition depends on h's competitiveness in the differentiated product, but only through the foreign export profits term:

$$\frac{\partial \Pi_X^h}{\partial c_D^l \partial \frac{N^h}{(m^h)^k)}} = \frac{1}{k(\tau^l)^2}\left(\frac{L^l}{\eta(k+2)}(\alpha+kc_D^l)\right)\frac{\partial \tau^l}{\partial \frac{N^h}{(m^h)^k}} + \frac{k+2}{(\tau^l)^2}\left(\frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+1}\right)\frac{\partial \tau^l}{\partial \frac{N^h}{(m^h)^k}}.$$

This is positive because $\frac{\partial \tau^l}{\partial \frac{N^h}{(m^h)^k)}} > 0$, so the exporters in h lose less from an increase in c_D^l as they get larger and more productive. The other terms in G^l are independent of N^h so as N^h increases, so does equilibrium c_D^l, while c_D^l is decreasing in m^h. These effects are in the same direction as Lemma 3, so tariffs are increasing in N^h and decreasing in m^h.

The competitiveness of l's firms affects the marginal benefits of an increase in c_D^l via both Π_D^l and Π_X^h:

$$\begin{aligned}\frac{\partial \Pi_X^h}{\partial c_D^l \partial \frac{N^l}{(m^l)^k)}} &= \frac{1}{k(\tau^l)^2}\left(\frac{L^l}{\eta(k+2)}(\alpha+kc_D^l)\right)\frac{\partial \tau^l}{\partial \frac{N^l}{(m^l)^k}} + \frac{k+2}{(\tau^l)^2}\left(\frac{L^l}{\gamma\phi^l}N_e^l(c_D^l)^{k+1}\right)\frac{\partial \tau^l}{\partial \frac{N^l}{(m^l)^k}} - \\ &\quad \frac{k+2}{\tau^l}\left(\frac{L^l(m^l)^k}{\gamma\phi^l}(c_D^l)^{k+1}\right)\end{aligned}$$

This expression has an ambiguous sign, but note that when its added to

$$\frac{\partial \Pi_D^l}{\partial c_D^l \partial \frac{N^l}{(m^l)^k)}} = (k+2)\left(\frac{L^l(m^l)^k}{\gamma\phi^l}(c_D^l)^{k+1}\right)$$

then we have

$$\beta \frac{\partial \Pi_X^h}{\partial c_D^l \partial \frac{N^l}{(m^l)^k}} + \frac{\partial \Pi_D^l}{\partial c_D^l \partial \frac{N^l}{(m^l)^k}} > 0$$

as long as $\beta \leq 1$. This implies the equilibrium c_D^l is increasing in N^l and decreasing in m^l. This effect is consonant with the effect from Lemma 3, and so equilibrium tariffs have the same pattern.

The argument for γ proceeds with nearly exactly the same steps with the signs reversed, so it is omitted here. The end result is that equilibrium tariffs are decreasing in γ.

Because $\frac{\partial \Pi_X^h}{\partial c_D^l}$ is decreasing in c_D^l the equilibrium c_D^l, and τ^l, is decreasing in β. Finally, and as in the NTB case, τ^l can go up or when ϵ^l increases.

A6: Positive Tariff Utility Maximizing

We will consider consumer utility in the vicinity of $\tau^l = 1$ which is a zero percent *ad valorem* tariff. When tariff revenue is redistributed, an individual consumer's utility is $U^l + \frac{T^l}{L^l}$, and slightly larger tariffs benefits consumers if $|\frac{1}{L^l}\frac{\partial T^l}{\partial \tau^l}| > |\frac{\partial U^l}{\partial \tau^l}|$ or equivalently, $|\frac{1}{L^l}\frac{\partial T_l}{\partial c_D^l}| > |\frac{\partial U^l}{\partial c_D^l}|$.

As noted in the text,

$$\frac{\partial U^l}{\partial c_D^l} = \frac{1}{2\eta}(-\alpha - \alpha\frac{k+1}{k+2} + 2\frac{k+1}{k+2}c_D^l).$$

Finding a tractable expression for $\frac{1}{L^l}\frac{\partial T_l}{\partial c_D^l}$ is considerably more involved, but the expression for the derivative simplifies considerably as $\tau^l \to 1$. First, note that

$$\frac{T_l}{L^l} = \frac{\tau^l - 1}{(\tau^l)^{k+1}} \frac{N_e^h}{\gamma(m^l)^k} \left(c_D^l\right)^{k+2} \frac{1}{k+2}$$

and therefore $\frac{1}{L^l}\frac{\partial T_l}{\partial c_D^l}$ is

$$\frac{\partial \tau^l}{\partial c_D^l}\frac{1}{(\tau^l)^{k+1}}\frac{N_e^h}{\gamma(m^l)^k}\left(c_D^l\right)^{k+2}\frac{1}{k+2}-\frac{\partial \tau^l}{\partial c_D^l}\frac{\tau^l-1}{(\tau^l)^{k+2}}\frac{N_e^h}{\gamma(m^l)^k}\left(c_D^l\right)^{k+2}\frac{k+1}{k+2}+\frac{\tau^l-1}{(\tau^l)^{k+1}}\frac{N_e^h}{\gamma(m^l)^k}\left(c_D^l\right)^{k+1}.$$

As $\tau^l \to 1$, however, the second and third terms will both equal zero, so we can focus on the first term only. After substituting in the definition of τ^l in terms of c_D^l and making some simplifications, we get

$$\begin{aligned}\frac{1}{L^l}\frac{\partial T_l}{\partial c_D^l} &= -\frac{1}{k}\frac{1}{k+2}\frac{(c_D^l)^{k+2}}{2\gamma}\left(\frac{2(k+1)\gamma}{\eta}\frac{-1}{(c_D^l)^{k+1}}-\frac{2(k+1)^2\gamma}{\eta}\frac{\alpha-c_D^l}{(c_D^l)^{k+2}}\right)\\ &= \frac{1}{2\eta}\left(\frac{2}{k}\frac{(k+1)^2}{k+2}\alpha-2\frac{k+1}{k+2}c_D^l\right)\end{aligned}$$

It has already been shown that $|\frac{\partial U^l}{\partial c_D^l}|$ is positive, therefore we only need to check that $\frac{1}{L^l}\frac{\partial T_l}{\partial c_D^l}-|\frac{\partial U^l}{\partial c_D^l}|>0$ to complete our proof. The difference turns out to be $\frac{1}{2\eta}\frac{\alpha}{k}$, which is positive because all of those parameters are greater than zero.

Using a similar set of steps, it is possible to show that that $\frac{1}{L^l}\frac{\partial T_l}{\partial c_D^l}+\frac{\partial U^l}{\partial c_D^l}$ is in the vicinity of the autarky cutoff, i.e. as $\tau^l\to\infty$. $\frac{\partial U^l}{\partial c_D^l}$ is as before, and $\frac{1}{L^l}\frac{\partial T_l}{\partial c_D^l}$ simplifies to

$$\frac{1}{\eta}\left(-\frac{k^2+k}{k+2}c_l^D-\frac{(k+1)^2}{k+2}\alpha\right).$$

Thus, $\frac{1}{L^l}\frac{\partial T_l}{\partial c_D^l}+\frac{\partial U^l}{\partial c_D^l}$ is

$$\frac{1}{\eta}\left(\frac{2k^2+4k+2}{k+2}c_D^l-\frac{2k^2+6k+5}{k+2}\alpha\right).$$

Because $\alpha > c_D^l$, this is negative, meaning consumer utility, when tariff revenue is redistributed costlessly, cannot be maximized through autarky. This is obvious, but the above expression can be used to determine when redistribution ensures that the economy will not be closed to trade in the differentiated good. The condition for this is $\frac{\partial G^l}{\partial c_D^l}=|\epsilon^l\frac{\partial T_l}{\partial c_D^l}+\epsilon^l L^l\frac{\partial U^l}{\partial c_D^l}|>\frac{\partial \Pi^l}{\partial c_D^l}$. Straightforwardly, $\frac{\partial \Pi^l}{\partial c_D^l}=\frac{L^h}{\gamma\phi^l}N_e^l(c_D^l)^{k+1}(k+2)$.

On inspection, if N_e^l is sufficiently small, and either m^l, γ or ϵ^l sufficiently large, then this condition will be met.

A7: Both Governments Can Find A Positive Tariff Utility-Maximizing

We will again consider the imposition of a small increase in tariffs in each country l and h, starting with a completely open economy. It is assumed that the two countries are symmetrical in every way, so the increases in tariffs will be equal, as well as all endogenous variables, for example the cutoffs. All superscripts are omitted.

Recall from Appendix A that the derivative of a single consumers utility from an increase in c_D at $\tau = 1$ is $\frac{1}{2\eta}\frac{\alpha}{k}$ so the rate of change of aggregate consumer utility is $\frac{L}{2\eta}\frac{\alpha}{k}$. For an increase in c_D, the domestic profits of l's producers increase at the rate

$$\frac{L}{\gamma\phi}N_e(c_D)^{k+1}(k+2).$$

For an increase in the foreign cutoff, which is also c_D when symmetry is imposed, the rate of change in profits for l's exporters, after some simplification, is

$$-\frac{L}{2\eta}\left(\frac{2(k+1)^2}{k(k+2)}\alpha - \frac{2(k+1)}{k+2}c_D\right) + \frac{L}{\gamma\phi}N_e(c_D)^{k+1}(k+2).$$

Thus, if the government is maximizing $G^l = \epsilon^l(L^l U^l + T^l) + \Pi^l$ the rate of change at $\tau = 1$ for a small joint increase in τ by both countries is:

$$\epsilon^l\frac{L}{2\eta}\frac{\alpha}{k} - \frac{L}{2\eta}\left(\frac{2(k+1)^2}{k(k+2)}\alpha - \frac{2(k+1)}{k+2}c_D\right) + \frac{2L}{\gamma\phi}N_e(c_D)^{k+1}(k+2).$$

This expression can be both positive or negative. For example, if ϵ^l is sufficiently large then it will be positive. If ϵ^l and $\frac{N_e}{m}$ are very small then it will be negative.

A8: Cooperative Tariff Setting with International Transfers, Special Case

Pareto efficiency requires that the following sum be maximized with respect to c_D^l and c_D^h:

$$W \equiv \epsilon^h G^l + \epsilon^l G^h.$$

Again relying on Lemma 1, we can maximize with respect to each cutoff separately, and then pursue the implications for trade policy by examining the definition of τ. The following assumptions radically simplify the problem, and make it analytically tractable: 1. $\epsilon^l = \epsilon^h$ 2. tariff revenue enters the governments objective function as a separate linear term with weight $\frac{1}{\epsilon^l(k+1)}$.

Under these assumptions, maximization of W with respect to c_D^l is equivalent to maximizing

$$\epsilon^l U^l + \frac{1}{k+1} T^l + \Pi_D^l + \Pi_X^h.$$

The tariff revenue term can be rearranged progressively in order to generate some useful simplifications:

$$\begin{aligned}
\frac{1}{k+1} T^l &= \frac{\tau^l - 1}{(\tau^l)^{k+1}} \frac{L^l}{\gamma \phi^h} N_e^h \left(c_D^l\right)^{k+2} \\
&= (\tau^l)^{-k} \frac{L^l}{\gamma \phi^h} N_e^h \left(c_D^l\right)^{k+2} - \frac{L^l}{\gamma \phi^h} N_e^h \tau^l \left(\frac{c_D^l}{\tau^l}\right)^{k+2} \\
&= \frac{L^l}{\gamma \phi^h} N_e^h \left(\frac{(m^h)^k}{N_e^h} \left(\frac{2(k+1)\gamma}{\eta} \frac{\alpha - c_D^l}{(c_D^l)^{k+1}} - \frac{N_e^l}{(m^l)^k}\right)\right) \left(c_D^l\right)^{k+2} - \Pi_X^h \\
&= \frac{L^l}{\eta(k+2)} \left(\alpha - c_D^l\right) c_D^l - \Pi_D^l - \Pi_X^h
\end{aligned}$$

Once this terms is added back to the terms in W which are a function of c_D^l, the resulting expression is quadratic in c_D^l:

$$\frac{\epsilon^l L^l}{2\eta}\left(\alpha - c_D^l\right)\left(\alpha - \frac{k+1}{k+2}c_D^l\right) + \frac{L^l}{\eta(k+2)}\left(\alpha - c_D^l\right)c_D^l.$$

The optimal c_D^l is then

$$c_D^l = \frac{(2k+3)\epsilon^l\alpha - 2\alpha}{2\epsilon^l(k+1) - 4}.$$

This is not a function of γ, N_e^l, N_e^h, m^l or m^h, therefore the optimal tariff rate will only depend on these quantities directly, i.e. not via their effect on c_D^l. The optimal τ^l is therefore decreasing in γ; increasing in N_e^l and N_e^h; and, decreasing in m^l or m^h.

A9: Cooperative Tariff Setting without International Transfers, Special Case

First, we will examine the NTB case. When the two countries are completely symmetric, then the governments' problem amounts to choosing a single domestic cutoff $c_D = c_D^l = c_D^h$ in order to maximize a common $G = G^l = G^h$ where

$$G = \epsilon U + \Pi_D + \Pi_X.$$

A number of simplifications of G are available, which make clear that the optimal c_D is not a function of γ, m or N_e.

$$\begin{aligned}
G &= \epsilon U + \Pi_D + \Pi_X \\
&= \frac{\epsilon L}{2\eta}\left(\alpha - c_D\right)\left(\alpha - \frac{k+1}{k+2}c_D\right) + \frac{L}{\gamma\phi}N_e(c_D)^{k+2} + \frac{L}{\gamma\phi}N_e(\nu)^2\left(\frac{c_D}{\nu}\right)^{k+2} \\
&= \frac{\epsilon L}{2\eta}\left(\alpha - c_D\right)\left(\alpha - \frac{k+1}{k+2}c_D\right) + \frac{L}{\gamma\phi}N_e(c_D)^{k+2} + \\
&\quad \frac{L}{\gamma\phi}N_e\left(\frac{(m)^k}{N_e}\left(\frac{2(k+1)\gamma}{\eta}\frac{\alpha - c_D}{(c_D)^{k+1}} - \frac{N_e}{(m)^k}\right)\right)(c_D)^{k+2} \\
&= \left(-\frac{\epsilon L}{2\eta}\frac{2k+3}{k+2}\alpha + \frac{\alpha L}{\eta(k+2)}\right)c_D + \left(\frac{\epsilon L}{2\eta}\frac{k+1}{k+2} - \frac{L}{\eta(k+2)}\right)(c_D)^2
\end{aligned}$$

The relationship between c_D and ϵ is ambiguous.

Comparing with the non-cooperative setting, recall from Proposition 2 that the economies must either be completely open or completely closed. If the former, then there are no gains to be had from trade negotiations. Consumers and domestic producers have settled their dispute in favor of consumers, and the government cannot improve the position of exporters through negotiations. If the latter, then equilibrium NTB rates will be less than ∞ as long as $\frac{\partial G}{\partial c_D} = 0$ at some c_D and $\frac{\epsilon L}{2\eta}\frac{k+1}{k+2} - \frac{L}{\eta(k+2)} < 0$, or if $G(\nu = 1) > G(\nu = \infty)$. Equilibrium NTB rates are weakly lower in the cooperative case than in the non-cooperative case.

A similar set of steps can be taken in the case where tariff revenue is redistributed, under the same assumptions that permitted analytic evaluation of the tariff case previously. Using a result from Appendix A , we first note that

$$\frac{1}{k+1}T = \frac{L}{\eta(k+2)}(\alpha - c_D)c_D - \Pi_D - \Pi_X.$$

This can then be plugged into the expression for G, which yields the same expression for G as above, and with the same implications for the comparative statics.

$$\begin{aligned} G &= \epsilon(U+T) + \Pi_D + \Pi_X \\ &= \frac{L}{2\eta}\left(\alpha - c_D\right)\left(\alpha - \frac{k+1}{k+2}c_D\right) + \frac{L}{\eta(k+2)}(\alpha - c_D)c_D \\ &= \left(-\frac{\epsilon L}{2\eta}\frac{2k+3}{k+2}\alpha + \frac{\alpha L}{\eta(k+2)}\right)c_D + \left(\frac{\epsilon L}{2\eta}\frac{k+1}{k+2} - \frac{L}{\eta(k+2)}\right)(c_D)^2 \end{aligned}$$

To compare the equilibrium tariff rates with the non-cooperative case, recall that the government chooses τ to maximize

$$\begin{aligned} G &= \epsilon(U+T) + \Pi_D \\ &= \left(-\frac{\epsilon L}{2\eta}\frac{2k+3}{k+2}\alpha + \frac{\alpha L}{\eta(k+2)}\right)c_D + \left(\frac{\epsilon L}{2\eta}\frac{k+1}{k+2} - \frac{L}{\eta(k+2)}\right)(c_D)^2 - \Pi_X \end{aligned}$$

This is identical to the expression in the cooperative tariff setting problem, except for the addition of the $-\Pi_X$. We already showed in Appendix A that Π_X is decreasing in c_D, therefore this term creates extra marginal benefits for the government from a higher c_D which implies higher tariff rates. Tariff rates are therefore weakly lower than in the non-cooperative equilibrium.

Appendix B: Numerical Simulations

Numerical simulations were conducted over the following range of parameter values:

Parameter	Range	Grid Points
N_e^l	$[100, 300]$	3
N_e^h	$[100, 300]$	3
m^l	$[2, 4]$	3
m^h	$[2, 4]$	3
γ	$[.2, .8]$	3
k	$[1.5, 3]$	3

In addition, three settings for $\epsilon^l = \epsilon^h$ are considered for all simulations.

Parameter	Range	Grid Points
Tariff revenue to producers setting	[.05,1.5]	1
Low ϵ^l setting	[.5,2]	9
No ϵ^l setting	[2,10]	9

These ranges were chosen to insure a reasonable rate of interior solutions. For evaluation and presentation of the comparative statics, a random draw from the set of ϵ^l values which don't lead to an interior solution is made. A total of 3^6 simulations are therefore made in each case.

Simulations are conducted under three institutional settings: a non-cooperative game with tariff revenue redistribution; a cooperative game with tariff revenue redistribution and international transfers; and, a cooperative game with tariff revenue redistribution and no international transfers. The first two of these are presented heuristically in Tables 4.1 and 4.2. The result of the simulations are also presented in Figures 4.1, 4.2 and 4.3 in order to show the sizes of the effects.

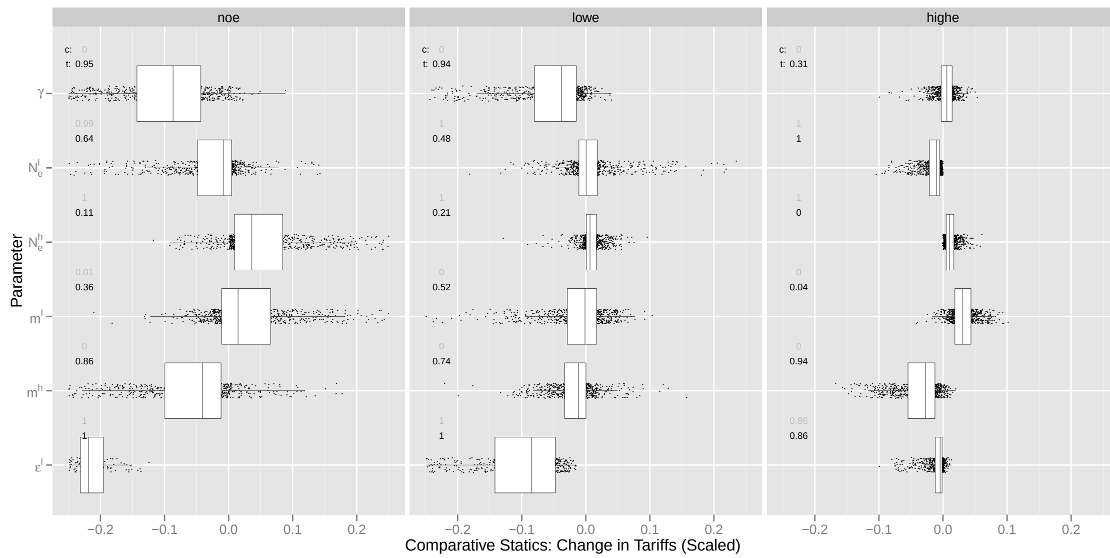

Figure 4.1: This figure reports the results of simulated comparative statics for an increase in each parameter in a non- cooperative setting with tariff revenue distributed. The left-most side presents the results when tariff revenue is a separate maximand in the governments objective function; the middle- and right-most when tariff revenue is distributed to consumers and the government places a low and high weight on consumer utility, respectively. To ease presentation, the comparative statics have been rescaled to fit on the same chart as described in Appendix B.

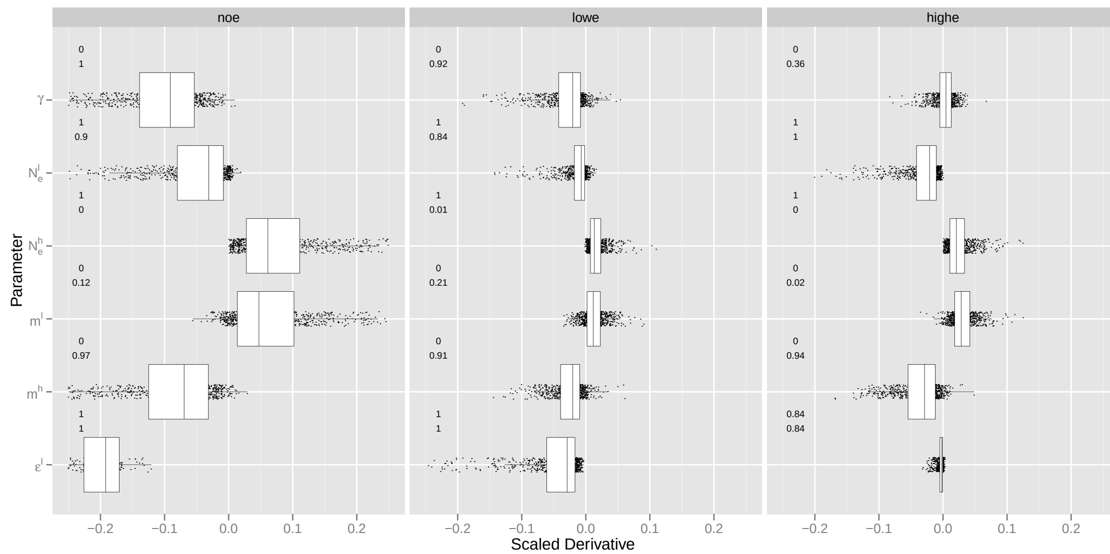

Figure 4.2: This figure reports the results of simulated comparative statics for an increase in each parameter in a cooperative setting with tariff revenue distributed.

Appendix C: Cooperative Bargaining without Transfers

Examining the Cooperative Game without International Transfers

Analysis of the model is complicated when an international transfer instrument is unavailable to the two sides. First, it is necessary to define some bargaining protocol in order to specify how the gains from trade negotiations will be distributed between the two countries. To keep the focus on the trade politics rather than complexities of the bargaining, I simply assume a fixed distribution of gains from negotiations. Second, the problem for the two countries now amounts to finding, if possible, a mutual reduction in trade barriers which maximizes the gains from these reductions while distributing those gains in a manner consistent with the bargaining weights. Except under two special cases, in which the countries are symmetric, the comparative statics are generally unidentifiable analytically for both the tariff and non-tariff barrier cases. I therefore again turn to numerical simulations to provide some sense of the their general direction.

Before discussing the bargaining, I will introduce some new notation to distinguish between cooperatively negotiated outcomes, which are subscripted with a c, and non-cooperative outcomes, superscripted with a n. If no agreement is struck, then the two sides will revert to the non-cooperative equilibrium trade policies. For example, for country l, the non-cooperative equilibrium rate of tariffs is denoted τ_n^l, and the reversion value for government utility is G_n^l, which is a function of both τ_n^l and τ_n^h. The gains from the bilateral agreement for l are therefore $G_c^l(\tau_c^l, \tau_c^h) - G_n^l(\tau_n^l, \tau_n^h)$.

Each country is assumed to have a bargaining weight θ^l such that $\theta^l + \theta^h = 1$. The total gains from any negotiated trade deal are assume to be distributed so that $\theta^l(G_c^l - G_n^l + G_c^h - G_n^h)$ goes to country l and all of the remaining goes to h. The negotiations then amount to the following constrained maximization problem:

$$\operatorname*{Max}_{\tau_c^l, \tau_c^h} G_c^l - G_n^l \quad s.t. \quad \theta^h(G_c^l - G_n^l) = \theta^l(G_c^h - G_n^h).$$

Of course, no agreement will be possible if there is no agreement which meets the above constraint and also improves the utility of each side relative to the non-cooperative equilibria. Also note that the constraint implies that any trade deal of the above form will be from the set of Pareto efficient trade deals without redistribution.

Two special cases permit analytical evaluation, which is otherwise not possible. The first of these is when two completely symmetric countries negotiate to reduce

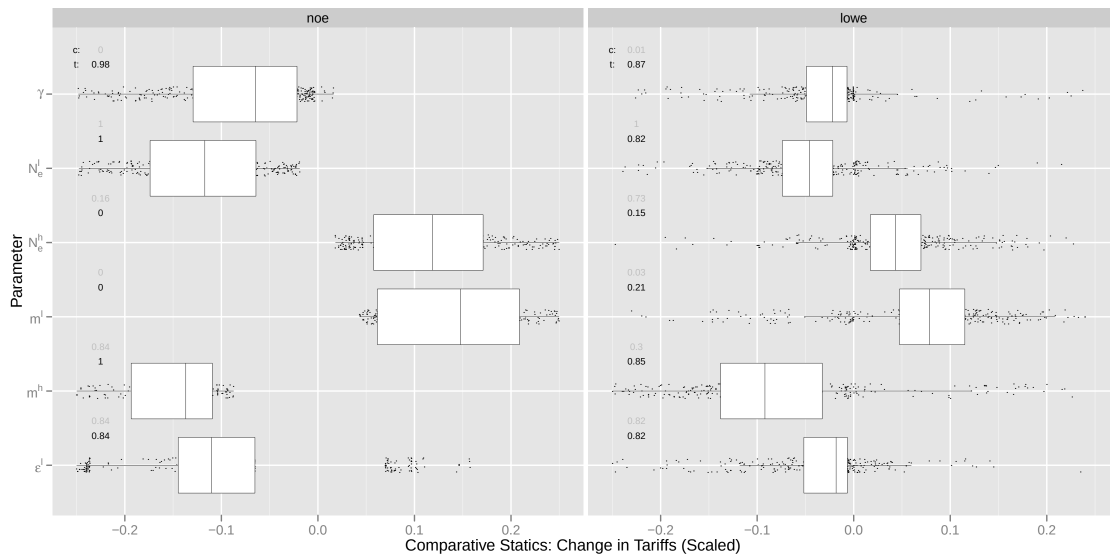

Figure 4.3: This figure reports the results of simulated comparative statics for an increase in each parameter in a cooperative setting without international transfers. Only comparative statics for the comparative disadvantage country, l, are reported. The left side presents the result for the NTB case and the right side for the tariff case. To ease presentation, the comparative statics have been rescaled to fit on the same chart as described in Appendix B.

an NTB, and the second of which is when two symmetric countries negotiate to reduce a tariff, and $\frac{1}{\epsilon(k+1)}$ of the tariff revenue is deadweight loss. Under this (quite particular) setting, a number of results are available.

Proposition 7. *When two completely symmetric countries negotiate a reduction in NTBs or tariffs (and when $\frac{1}{\epsilon(k+1)}$ of the tariff revenue is deadweight loss), then the negotiated trade barriers are (weakly) lower than the non-cooperatively determined trade barriers. In addition, ν^l and τ^l are:*

1. *Decreasing in γ*
2. *Increasing in N_e and decreasing in m.*
3. *Ambiguous in ϵ.*

The only instances where trade barriers are not reduced via the negotiations occur where either autarky maximizes the governments' utility in both cooperative and non-cooperative settings, or, in the case of NTBs, if a completely open economy prevails even in the non-cooperative setting. In both of these cooperative special cases, the equilibrium cutoff is not affected by changes in γ or the comparative advantage parameters, so the comparative statics are fully determined by the "maintaining competition" effects in Lemma 3. Note that the symmetry assumption requires that both sides change equally, so the interpretation of these comparative statics for the comparative advantage factors is slightly changed, too. Finally, ϵ plays an ambiguous role here for the same reason it did so in the previous section. Increasing ϵ raises the power of one pro-trade group in society, consumers, while weakening the power of producers who in this symmetric case can be a force for either higher or lower trade barriers. If the latter, then weakening their bargaining power relative to consumers may lead to higher trade barriers.

When the two countries are not symmetric, analysis of the model is not possible but numerical simulations help provide some sense of the general direction of the comparative statics. The results of these simulations are presented in Figure 3 for both the NTB and tariff cases. It is assumed that the two countries have equal bargaining weights. Across a large number of the simulations, the mutually utility-maximizing cooperative trade deal involves the country with a comparative advantage in the production of the differentiated product adopting a completely open economy, while the country at a comparative disadvantage has a positive rate of tariffs or NTBs. This positive rate is necessary to ensure that the gains from the trade deal comport with the bargaining weights. Figure 3 therefore only presents the comparative statics for the trade policy for the country *at a comparative disadvantage* in the differentiated product. For the simulations presented, this is country l. There were so many instances of zero change in the trade policy for the comparative advantage country that the comparative statics were not worth reporting.

The comparative statics for γ, N_e^h, and m^h were essentially the same as in the special cases in Proposition 7. The comparative statics for ϵ^l were also consistent with the logic of Proposition 7, although despite the theoretical ambiguity an increase in the weight on consumer utility still generally lowers tariffs, which seems sensible. The only significant difference between the symmetric and non-symmetric cases therefore lies with N_e^l and m^l. When $\frac{N_e^l}{(m^l)^k}$ increases, l's comparative disadvantage is reduced. It therefore requires fewer concessions from h in the trade negotiations in order to achieve its allotted share of the gains from the negotiation. If h's tariff or NTB rate is already near 1, this amounts to l's reducing its negotiated tariff in order to transfer some of the profits from its domestic producers to h's exporters. The case without inter-country transfers therefore features the opposite logic as most of the other cases: here, weak industries are usually more protected while strong, productive industries are less protected. The constraint imposed by the bargaining weights imposes this 'inefficient' – from the government's perspective – trade policy on the two sides.

Bibliography

Abel-Koch, J. 2010. "Endogenous Trade Policy with Heterogeneous Firms." *University of Mannheim, Centre for Doctoral Studies in Economics, Discussion Papers* .

Albuquerque, R. and S. Rebelo. 2000. "On the dynamics of trade reform." *Journal of International Economics* 51(1):21–47.

Alt, J.E., J. Frieden, M.J. Gilligan, D. Rodrik and R. Rogowski. 1996. "The political economy of international trade." *Comparative Political Studies* 29(6):689–717.

Antras, P. 2003. "Firms, Contracts, and Trade Structure." *Quarterly Journal of Economics* 118(4):1375–1418.

Antras, Pol and Elhanan Helpman. 2004. "Global Sourcing." *Journal of Political Economy* 112(3).

Aw, B.Y., S. Chung and M.J. Roberts. 2000. "Productivity and turnover in the export market: micro-level evidence from the Republic of Korea and Taiwan (China)." *The World Bank Economic Review* 14(1):65.

Bagwell, K. and R.W. Staiger. 1999. "An economic theory of GATT." *American Economic Review* 89(1):215–248.

Baron, Reuben M. and David A. Kenny. 1986. "The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations." *Journal of personality and social psychology* 51(6):1173–1182.

Bergsten, C.F. and M. Noland. 1993. *Reconcilable Differences?: United States-Japan Economic Conflict*. Peterson Institute.

Bernard, A.B., J. Eaton, J.B. Jensen and S. Kortum. 2003. "Plants and productivity in international trade." *American Economic Review* 93(4):1268–1290.

Bernard, A.B. and J.B. Jensen. 1999. "Exceptional exporter performance: cause, effect, or both?" *Journal of international economics* 47(1):1–25.

Bernard, A.B. and J.B. Jensen. 2004. "Why some firms export." *Review of Economics and Statistics* 86(2):561–569.

Bernard, A.B., J.B. Jensen, S.J. Redding and P.K. Schott. 2007. "Firms in international trade." *Journal of Economic Perspectives* 21(3):105–130.

Bernard, A.B., S.J. Redding and P.K. Schott. 2008. "Comparative Advantage and Heterogeneous Firms." *The Review of Economic Studies* 74(1):31–66.

Bhagwati, J. 1999. "Regionalism and multilateralism: an overview." *Trading Blocs. Alternative Approaches to Analyzing Preferential Trade Agreements* pp. 3–32.

Bombardini, M. 2008. "Firm heterogeneity and lobby participation." *Journal of International Economics* 75(2):329–348.

Bombardini, M. and F. Trebbi. 2012. "Competition and Political Organization: Together or Alone in Lobbying for Trade Policy?" *Journal of International Economics* 87(1):18–26.

Brainard, SL. 1997. "An empirical assessment of the proximity-concentration trade-off between multinational sales and trade." *The American economic review* 87.

Brander, J.A. and B.J. Spencer. 1984. "Trade warfare: tariffs and cartels." *Journal of International Economics* 16(3-4):227–242.

Brander, J.A. and B.J. Spencer. 1992. "Tariff protection and imperfect competition." *Imperfect competition and international trade* pp. 107–119.

Broda, Christian and David E Weinstein. 2006. "Globalization and the Gains from Variety." *The Quarterly Journal of Economics* 121(2):541–585.

Brülhart, M. 2009. "An Account of Global Intra-industry Trade, 1962–2006." *The World Economy* 32(3):401–459.

Caves, Richard E. 2000. "The multinational enterprise as an economic organization." *International Political Economy: Perspectives On Global Power and Wealth* p. 145.

Chang, P.L. and G. Willmann. 2006. "Protection for Sale with Heterogeneous Interests within Industries.". Unpublished working paper.

Chase, K.A. 2003. "Economic interests and regional trading arrangements: The case of NAFTA." *International Organization* 57(01):137–174.

Chase, K.A. 2004. "From Protectionism to Regionalism: Multinational Firms and Trade-Related Investment Measures." *Business and Politics* 6(2):1–36.

Clark, G.L. and N. Wrigley. 1995. "Sunk costs: a framework for economic geography." *Transactions of the Institute of British Geographers* 20(2):204–223.

Clark, Tom S and Drew A Linzer. 2012. "Should I Use Fixed or Random Effects?" *Unpublished paper* .

Clerides, S.K., S. Lach and J.R. Tybout. 1998. "Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico, and Morocco*." *Quarterly Journal of Economics* 113(3):903–947.

Cole, M.T. and R.B. Davies. 2011. "Strategic tariffs, tariff jumping, and heterogeneous firms." *European Economic Review* 55(4):480–496.

CRS. 2008*a*. The Proposed U.S. South Korea Free Trade Agreement (KORUS FTA): Provisions and Implications. Technical Report RL34330 Congressional Research Service.
URL: *http://www.fas.org/sgp/crs/row/R41481.pdf*

CRS. 2008*b*. US-South Korea Relations. Technical Report R41481 Congressional Research Service.
URL: *http://fpc.state.gov/documents/organization/151976.pdf*

Das, S.P. 1990. "Foreign lobbying and the political economy of protection." *Japan and the World Economy* 2(2):169–179.

Davis, C.L. 2004. "International institutions and issue linkage: Building support for agricultural trade liberalization." *American Political Science Review* 98(1):153–169.

Davis, Donald R and David E Weinstein. 1999. "Economic geography and regional production structure: an empirical investigation." *European economic review* 43(2):379–407.

De Loecker, J. 2007. "Do exports generate higher productivity? Evidence from Slovenia." *Journal of International Economics* 73(1):69–98.

Delgado, M.A., J.C. Farinas and S. Ruano. 2002. "Firm productivity and export markets: a non-parametric approach." *Journal of international Economics* 57(2):397–422.

Demidova, S. and A. Rodríguez-Clare. 2009. "Trade policy under firm-level heterogeneity in a small economy." *Journal of International Economics* 78(1):100–112.

Dixit, A.K. and J.E. Stiglitz. 1977. "Monopolistic competition and optimum product diversity." *The American Economic Review* 67(3):297–308.

Drope, J.M. and W.L. Hansen. 2006. "Does firm size matter? Analyzing business lobbying in the United States." *Business and Politics* 8(2):1–17.

Eichengreen, B. and J.A. Frankel. 1995. "Economic regionalism: Evidence from two 20th century episodes." *The North American Journal of Economics and Finance* 6(2):89–106.

Feenstra, R.C. 2004. *Advanced international trade: theory and evidence*. Princeton Univ Pr.

Felbermayr, G. and B. Jung. 2012. Unilateral trade liberalization in the Melitz model: A note. Technical report University of Tübingen working papers in economics and finance.

Felbermayr, G., B. Jung and M. Larch. 2011. "Optimal Tariffs, Retaliation and the Welfare Loss from Tariff Wars in the Melitz Model." *CESifo Working Paper Series No. 3474* .

Frieden, J.A. 1991. *Debt, development, and democracy*. Princeton University Press.

Gatto, M.D., G. Mion and G.I.P. Ottaviano. 2006. "Trade integration, firm selection and the costs of non-Europe." *CORE Discussion Papers* .

Gawande, K., P. Krishna and M.J. Robbins. 2006. "Foreign Lobbies and US Trade Policy." *The Review of Economics and Statistics* 88(3):563–571.

Gilligan, M.J. 1997. "Lobbying as a private good with intra-industry trade." *International Studies Quarterly* 41(3):455–474.

Gilpin, R. 1971. "The politics of transnational economic relations." *International Organization* 25(3):398–419.

Glynn, Adam N. 2012. "The product and difference fallacies for indirect effects." *American Journal of Political Science* 56(1):257–269.

Goldstein, J. and R. Gulotty. 2011. "Tariffs, Treaties and Delegation.".

Green, Donald P, Shang E Ha and John G Bullock. 2010. "Enough already about "black box" experiments: Studying mediation is more difficult than most scholars suppose." *The Annals of the American Academy of Political and Social Science* 628(1):200–208.

Grossman, Gene M and Elhanan Helpman. 2002. "Integration versus outsourcing in industry equilibrium." *The Quarterly Journal of Economics* 117(1):85–120.

Grossman, G.M. and E. Helpman. 1994. "Protection for sale." *The American Economic Review* 84(4):833–850.

Grossman, G.M. and E. Helpman. 1995*a*. "The Politics of Free-Trade Agreements." *The American Economic Review* 85(4):667–690.

Grossman, G.M. and E. Helpman. 1995*b*. "Trade wars and trade talks." *Journal of Political Economy* 103(4):675–708.

Grubel, H.G. and PJ Lloyd. 1971. "The empirical measurement of intra-industry trade." *The Economic Record* 47(120):494–517.

Grubel, H.G. and P.J. Lloyd. 1975. *Intra-industry trade: The theory and measurement of international trade in differentiated products*. Vol. 12 Macmillan London.

Hathaway, O.A. 1998. "Positive feedback: the impact of trade liberalization on industry demands for protection." *International Organization* 52(03):575–612.

Helpman, E. 1984. "A simple theory of international trade with multinational corporations." *The Journal of Political Economy* pp. 451–471.

Helpman, E. 1990. "Monopolistic competition in trade theory." *Princeton Studies in International Economics* .

Helpman, E. 1997. Politics and trade policy. In *Advances in economics and econometrics: theory and applications: seventh world congress*. Vol. 1 Cambridge Univ Pr p. 19.

Helpman, E. and P.R. Krugman. 1985. *Market structure and foreign trade*. MIT press Cambridge, MA.

Helpman, Elhanan, Marc J Melitz and Stephen R Yeaple. 2004. "Export Versus FDI with Heterogeneous Firms." *The American Economic Review* 94(1):300–316.

Hillman, A.L. 1982. "Declining industries and political-support protectionist motives." *The American Economic Review* 72(5):1180–1187.

Hillman, A.L. and H.W. Ursprung. 1988. "Domestic politics, foreign interests, and international trade policy." *The American Economic Review* pp. 729–745.

Hiscox, M.J. 2001. "Class versus industry cleavages: inter-industry factor mobility and the politics of trade." *International Organization* 55(01):1–46.

Hufbauer, G.C. and J.G. Chilas. 1974. Specialization by industrial countries: extent and consequences. In *The International Division of Labour, Problems and Perspectives, International Symposium, Tübingen*. pp. 3–38.

Husted, S. 1991. "Foreign lobbying: A theoretical analysis." *Eastern Economic Journal* 17(1):89–99.

Imai, Kosuke, Luke Keele, Dustin Tingley and Teppei Yamamoto. 2011. "Unpacking the black box of causality: Learning about causal mechanisms from experimental and observational studies." *American Political Science Review* 105(4):765–789.

Imai, Kosuke, Luke Keele and Teppei Yamamoto. 2010. "Identification, inference and sensitivity analysis for causal mediation effects." *Statistical Science* 25(1):51–71.

Irwin, D.A. 1995. "The GATT in historical perspective." *The American economic review* 85(2):323–328.

Johnson, H.G. 1953. "Optimum tariffs and retaliation." *The Review of Economic Studies* 21(2):142–153.

Kee, H.L., A. Nicita and M. Olarreaga. 2009. "Estimating trade restrictiveness indices." *Economic Journal* 119:172–199.

Kim, I. 2012. "A Theory of Open Trade with Heterogeneous Firms." *In progress* .

Kono, D.Y. 2009. "Market structure, electoral institutions, and trade policy." *International Studies Quarterly* 53(4):885–906.

Krugman, P. 1980. "Scale economies, product differentiation, and the pattern of trade." *The American Economic Review* 70(5):950–959.

Krugman, P.R. 1981. "Intraindustry specialization and the gains from trade." *The Journal of Political Economy* pp. 959–973.

Lancaster, K. 1979. *Variety, equity, and efficiency: product variety in an industrial society*. Columbia University Press New York.

Lileeva, A. and D. Trefler. 2007. "Improved access to foreign markets raises plant-level productivity... for some plants." *NBER Working Paper* .

Luttmer, E.G.J. 2007. "Selection, growth, and the size distribution of firms." *The Quarterly Journal of Economics* 122(3):1103–1144.

Mansfield, E. and H. Milner. 1999. "The new wave of regionalism." *International Organization* 53(3):589–627.

Mansfield, E.D. and E. Reinhardt. 2003. "Multilateral determinants of regionalism: The effects of GATT/WTO on the formation of preferential trading arrangements." *International Organization* pp. 829–862.

Markusen, James R and Anthony J Venables. 2000. "The theory of endowment, intra-industry and multi-national trade." *Journal of international economics* 52(2):209–234.

Marvel, H.P. and E.J. Ray. 1987. "Intraindustry trade: Sources and effects on protection." *The Journal of Political Economy* 95(6):1278–1291.

Mata, J. 1991. "Sunk costs and entry by small and large plants." *Entry and market contestability: An international comparison* pp. 49–62.

Mathieu, G. 1970. "The history of the ECSC: good times and bad." *Le Monde* 7(874).

Mayer, T. and G.I.P. Ottaviano. 2008. "The happy few: the internationalisation of European firms." *Intereconomics* 43(3):135–148.

McCallum, John. 1995. "National borders matter: Canada-US regional trade patterns." *The American Economic Review* pp. 615–623.

Melitz, M.J. 2003. "The impact of trade on intra-industry reallocations and aggregate industry productivity." *Econometrica* 71(6):1695–1725.

Melitz, M.J. and G.I.P. Ottaviano. 2008. "Market size, trade, and productivity." *Review of Economic studies* 75(1):295–316.

Milner, Helen. 1988*a*. "Trading places: Industries for free trade." *World Politics* 40(3):350–376.

Milner, H.V. 1988*b*. *Resisting protectionism: Global industries and the politics of international trade*. Princeton University Press Princeton, NJ.

Milner, H.V. 1997. "Industries, governments, and regional trade blocs." *The political economy of regionalism* pp. 77–106.

National Council of Textile Organizations, The. 2005*a*. "NCTO Applauds Major Improvements in CAFTA that will Promote Textile Exports and Protect Textile Jobs." Press release. Available at: http://www.ncto.org/newsroom/pr200526.pdf. Accessed September 2nd, 2012.

National Council of Textile Organizations, The. 2005*b*. "Textile-State Members Provide Critical Margin in CAFTA Vote." Press release. Available at: http://www.ncto.org/newsroom/pr200527.pdf. Accessed September 2nd, 2012.

National Textile Association, The. 2005. "National Textile Association Responds to Report of CAFTA textile 'fixes'." Press release. Available at: http://www.nationaltextile.org/ news/2005_07_26.htm. Accessed August 17th, 2012.

OECD. 2002. "Intra-industry and Intra-firm Trade and the Internationalization of Production." *Organization for Economic Cooperation and Development* p. <http://www.oecd.org/ dataoecd/6/18/2752923.pdf>.

Ossa, R. 2010. "A 'new trade' theory of GATT/WTO negotiations." *NBER Working Paper* .

Ottaviano, G., T. Tabuchi and J.F. Thisse. 2002. "Agglomeration and Trade Revisited*." *International Economic Review* 43(2):409–435.

Pavcnik, N. 2002. "Trade liberalization, exit, and productivity improvements: Evidence from Chilean plants." *The Review of Economic Studies* 69(1):245–276.

Plouffe, M. 2011. "The New Political Economy of Trade: Heterogeneous Firms and Politics." *In progress* .

Rauch, James E. 1999. "Networks versus markets in international trade." *Journal of international Economics* 48(1):7–35.

Rodrik, D. 1995. "Political economy of trade policy." *Handbook of international economics* 3:1457–1494.

Rogowski, R. 1989. "Commerce and coalitions: How trade affects domestic political alignments." *Princeton, NJ* .

Sadrieh, F. and M. Annavarjula. 2005. "Firm-specific determinants of corporate lobbying participation and intensity." *Journal of Public Administration* 28(1-2):179–202.

Sager, M.A. 1997. "Regional trade agreements: Their role and the economic impact on trade flows." *The World Economy* 20(2):239–252.

Schattschneider, E.E. 1935. *Politics, pressures, and the tariff*. Ayer Publishing.

Shuster, G. 2005. "Statement to the House, Committee on Ways and Means, April 21st, 2005." Available at: http://bulk.resource.org/gpo.gov/hearings/109h/23918.txt. Accessed August 17th, 2012.

Stoyanov, A. 2009. "Trade policy of a free trade agreement in the presence of foreign lobbying." *Journal of International Economics* 77(1):37–49.

Trefler, Daniel. 1995. "The case of the missing trade and other mysteries." *The American Economic Review* pp. 1029–1046.

Tybout, J.R. 2003. "Plant-and Firm-Level Evidence on ŞNewŤ Trade Theories." *Handbook of international trade* pp. 388–415.

USITC. 2004. U.S.-Australia Free Trade Agreement: Potential Economywide and Selected Sectoral Effects. Technical Report Investigation No. TA–2104-11 United States International Trade Commission, Department of Commerce.
URL: *http://www.usitc.gov/publications/332/pub3697.pdf*

USITC. 2007. U.S.-Korea Free Trade Agreement: Potential Economywide and Selected Sectoral Effects. Technical Report Investigation No. TA–2104-24 United States International Trade Commission, Department of Commerce.
URL: *http://www.usitc.gov/publications/332/pub3949.pdf*

Van Biesebroeck, J. 2005. "Exporting raises productivity in sub-Saharan African manufacturing firms." *Journal of International economics* 67(2):373–391.

Walter, S. 2010. "Globalization and the Welfare State: Testing the Microfoundations of the Compensation Hypothesis." *International Studies Quarterly* 54(2):403–426.

Wolf, Holger C. 2000. "Intranational home bias in trade." *Review of Economics and Statistics* 82(4):555–563.

Wonnacott, P. and M. Lutz. 1989. "Is there a case for free trade areas?" *Free Trade Areas and US Trade Policy* 59:84.

Yeaple, S., E. Helpman and M. Melitz. 2004. "Export versus FDI with Heterogeneous Firms." *American Economic Review* 94:300–316.